SEPTEMBER 21, 1959

American Machinist

THE MAGAZINE OF METALWORKING MANUFACTURING

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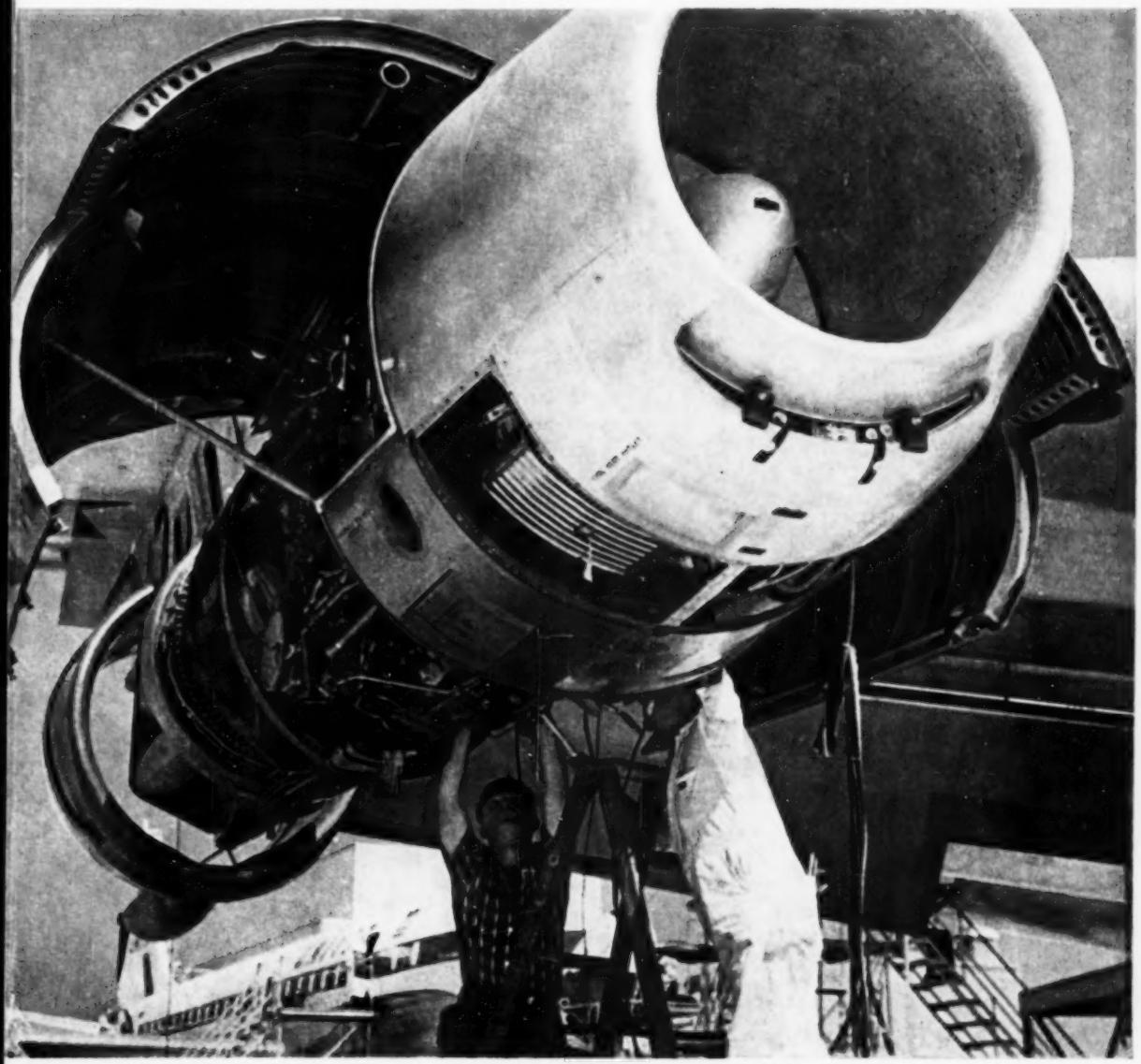


Ryan makes 80-lb titanium access doors for the DC-8 — see page 118

Where Metalworking will be in 1962
page 141

Which rake angle for carbide?
page 120

Our apprenticeship setup is a SCANDAL!
page 124

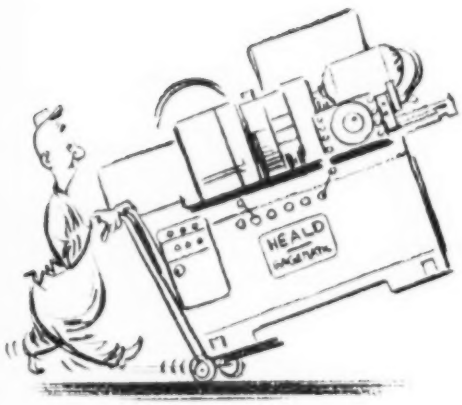
WHY WAIT

longer

for a new machine?

Chances are, Heald has it

IN STOCK!



As a result of Heald's recently instituted stock machine program, the most popular types and sizes of Heald precision finishing machines are normally carried in factory stock at Worcester. Any time you can buy a *stock machine*, and supply your own fixtures and tooling, you get these important advantages . . .

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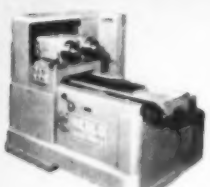
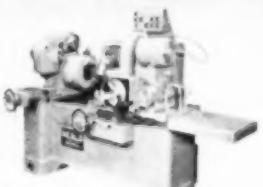
THESE STANDARD HEALD MACHINES ARE NORMALLY CARRIED IN STOCK



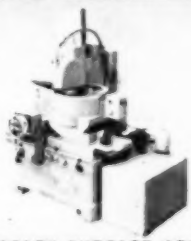
BORE-MATICS

Model "0"
Model 121
Model 221
Model 321
Model 421
Model 222
Model 322
Model 422



INTERNAL GRINDERS

Model 171 Size-Matic
Model 171 Gage-Matic
Model 271 Plain
Model 271 Size-Matic
Model 271 Gage-Matic
Model 271 Tool Room
Model 272 Basic
Model 273A Universal



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Model 261 16" Plain
Model 261 16" Automatic
Model 361 24" Plain
Model 361 24" Automatic

TOOL SHARPENING MACHINES

Model 3
Model 4

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COVER:

Weight savings on the Douglas jet airliner mean money in the bank for the airlines. For details on how 80-lb titanium access doors are fabricated, see page 118.

American Machinist

THE MAGAZINE OF METALWORKING MANUFACTURING

contents for September 21, 1959

VOLUME 103, NO. 20

How good is electron-beam welding? . . . A thorough study at the Westinghouse Bettis Atomic Power Laboratory brings a favorable vote. 113

Two checks for angular-contact ball bearings . . . Simple setups determine angle of contact and match a pair of angular bearings. *By Richard Smith, McGill Mfg Co.* 115

Verti-Slide forms wiper dies at 65% savings . . . Vertical four-slide machine replaces six presses in forming sheet-metal part. *By B F Burnham and R C Pedrick, General Electric Co.* 116

Titanium adds 5 seats to DC-8 jet flights . . . Biggest commercial use of titanium to date is 945 lb on each DC-8. 118

Which rake angle for carbide inserts? . . . Positive and negative rakes each have their advantages. *By Horace Frommelt, Spring Garden Institute.* . . 120

Height measurement comes of age . . . Now it has caught up with other methods of gaging. *By William T Nystrom, Brown & Sharpe Mfg Co.* 122

Our apprenticeship setup is a scandal! . . . Nationwide survey just completed by Department of Labor shows tool and die industry is dying for lack of new blood. 124

Guide to lubricants for machine tools . . . A detailed review of recommendations for all the mechanisms involved in machine tools. *By B M Dunham, Sun Oil Co.* 127

No carbon copies in industrial safety . . . You have to develop your own plan to suit your own needs. 133

Watervliet Arsenal advances gage design . . . Gage Laboratory constantly seeks to simplify and improve gaging practice. *By Rupert Le Grand.* 134

Induction heating . . . fast, clean, versatile . . . A basic review of what you can do with this process. *By D H Lapray, General Electric Co.* 138

SPECIAL REPORT NO. 479

Where Metalworking will be in 1962 . . . A forecast of production and capacity levels for each of the major metalworking industries. 141

REFERENCE BOOK SHEETS

Corrosion resistance of metals, I, II, III . . . Relative resistance of metals to electrochemical attack. 153

TURN PAGE FOR METALWORKING REPORT →

TRENDS

Metalworking Report . . 2
Spot News . . 95
Washington . . 97
Detroit . . 99
Aircraft and Missiles . . 101
Machine Tools . . 103
Materials . . 105
What's Ahead . . 107
Field Report . . 193

Departments . . .

Letters . . 88
Calendar . . 91
Editorial . . 111
Talking Shop . . 161
Practical Ideas . . 162
New Equipment . . 165
Names . . 235
New Books . . 240

METALWORKING REPORT

Significant current developments in tooling and production processes

CUTTING

Building-Block Cutters

A new method of assembling special milling cutters from stamped wafers will soon be announced. Basic tool geometry of the cutter is incorporated in the flat wafers, which can be economically stamped in large quantities. The wafers are assembled on an arbor. Tips of carbide or high-speed steel are placed on the cutter, and the entire assembly is brazed into a solid piece.

The process, developed by Spiral Carbide Tool Co, 12931 Artesian St, Detroit 23, Mich, is expected to substantially reduce the cost of new and replacement cutters. In addition, the cutters have increased density, acting as a vibration damper and reducing the tendency to chatter. Heat dissipation at the cutting edges is also said to be improved.

Spiral Carbide Tool plans to make tools by the new process to order and will also license the process.

Which Rake Angles?

Positive rake for carbide tools usually means the tools will cut better, but negative rake is more economical when all factors are considered. Recently completed cutting tests at the Spring Garden Institute show that even large percentage increases in cutting efficiency when positive-rake tools are applied may be overbalanced by the fact that more cutting edges can be ground into a carbide insert when negative rake is planned. Longer, less expensive cutting life for negative-rake tools is usually more important economically than more important economically. For details of the study, see p120.

FORMING

"Spark Bomb"

Here's another entrant in the "explosive forming" field. It is an underwater explosion created electrically.

The "spark bomb," as it is called by Adolph Kastelowitz, director of manufacturing research, Republic Aviation Corp, is being used experimentally for certain forming operations on high-strength metals. Republic is working, Mr. Kastelowitz said, toward eventual development of the device as a standard machine costing about $50,000, to replace large presses.

The detonator operates on the same principle as lightning. Power is fed into capacitors wired to two electrodes immersed in water. When the discharge switch is tripped, the explosion occurs, complete with lightning flash and thunderclap. The spark travels through the water in 40 millionths of a second, creating a shock wave. This shock wave acts like a similar wave produced by detonation of explosive, to instantly shape the blank to the die form. So far, the spark bomb has been able to release energy equal to 6000 hp.

Mandrelled Forging

Pierced blanks are slipped over a mandrel, then forged to the mandrel OD to produce an ID shape in the forging. This new approach by Alco Products, Inc, eliminates numerous conventional welds and seams normally required when high-accuracy tanks and tub shapes are formed. Reactor shells for SM-1A, the Army's first field-installed power reactor that is being constructed at Fort Greely, Alaska, are built stronger with less wall thickness this way.

Automatic Ring Forging

Various ring-shaped parts from 2 in. I.D. to 22 in. O.D. and up to 30 lb in weight are now hot forged and ring rolled automatically on new equipment designed by Wagner & Co, Dortmund, Germany. End uses for the forgings: bearing races, gears, etc, with various cross-sectional contours.

To achieve automatic operation, Wagner has developed a forging press that takes eccentrically cut or broken billets and produces preformed ring blanks of uniform shape and accurate volume. A hydraulic compensating device at the second press station stops punch movement when the previously upset billet is expanded to fill the closed-die cavity. Thus, the volume of the surrounding blank is always the same; any excess is thrown into the web, where it is punched out at the third station.

With this automatic line it is no longer necessary to saw billets or segregate broken or sheared billets into weight classifications, and reset the tools to suit. One man operates the line. When set up to produce rings of about 2 lb., the production is 450 rings per hr.

Fast Vertislide Payoff

General Electric says their new vertical four-slide machine has paid off in a "remarkably short time," meaning that the period required to justify the machine economically is so short that it is really remarkable. The machine was justified on the basis of one small sheet-metal part, and full production for a year was completed in three shifts. In addition, the machine is utilized for a number of other sheet-metal and wire parts with complex contours in three dimensions. Most applications will be on parts now being purchased outside the company. For further details, see p116.

HEAT TREATING

Treating New Jet-Liner Parts

Forged and extruded fuselage and wing sections of the Convair 880 and the Douglas DC-8 are conditioned in heat - treating furnaces ranking among the world's largest. Both furnaces were built by Despatch Oven Co, Minneapolis, and are electrically heated.

The heat treatment, in both cases, consists of holding the parts at 800-

1000 F and then plunging them into a water quench. At Convair, the sections are then placed in a freezer and held at –20 F until subsequent draw forming. Convair's furnace treats beams (up to 40 ft long) which are draw-formed into hemispherical belt-frame sections and joined together to make the 880's fuselage. The furnace is more than 42 ft long and stands 28 ft above the floor.

Douglas' 37-ft-8-in.-high furnace is reported to be the tallest bottom-entry furnace ever built. It treats forgings that comprise the wings and fuselage of the DC-8 (see cover).

Wind Tunnel in a Furnace

Furnaces are now being built that are limited not by the ability to produce and distribute heat, but by the physical ability of the workpiece to absorb the heat. This is the claim of Surface Combustion Corp, Toledo, Ohio, for its new Power-Convection principle of heat treating which, in effect, creates a wind tunnel in the furnace.

High-horsepower fans mounted within the furnaces circulate air at velocities up to 200 mph; compare this with the normal rate of about 4 mph. Direction of the air stream is controlled by jets and baffles. In one application, jets placed on either side of a vertical workpiece also serve to support it.

Other advantages include faster cooling rates, more uniform heat treatment under controlled atmospheres, and increased production per unit of floor space. Each furnace designed with this new principle is a custom job. Already in operation are batch furnaces, continuous strip furnaces, and roller hearth furnaces. One roller hearth furnace, using Power Convection, anneals and cools 8000 lb of brass and cupro-nickel tubing per hr, and maintains temperature uniformity of ±8 F.

INSPECTION

X-Ray Standards

Standardized X-ray pictures for the measuring of the strength of cast steel without need of destructive testing will be available after a year's time. Convair (San Diego) Div of General Dynamics Corp has a $61,000 contract from the Wright Air Development Center to develop the standards as they relate to acceptability of imperfections.

Convair will induce imperfections in cast slab, X-ray the bars, and then test them to destruction. By comparing these X-rays and strength characteristics with those of perfect slab, standards can be set up. The standards will be made available to industry, after Convair's 12-month program is completed.

A similar program for aluminum and magnesium castings was recently completed. The standards are now being used by Convair.

Gun Gaging

Air gages replace old-style star gages when Watervliet Arsenal inspects gun bores. One gage design with slight variations serves for all guns from 40 mm up. Two opposed sensing devices in spring-loaded elements bear against opposite sides of the gun bore to give continuous readings on depth of rifling from one end of the bore to the other. Variations in rifling depth are magnified 250 times where readings are taken. Eccentricity in the bore can be quickly detected by indexing the gage head into different rifling grooves. For details on the arsenal's up-to-date gaging and inspecting program, see p134.

THE OUTLOOK

Steel shortages caused by the prolonged strike are bound to have an adverse effect on production in many segments of metalworking, considering the length of time it will take to get the nation's steel inventories back to normal. And there's already a "gray market" in steel (see p107).

WELDING

New Processes

Many new ideas will be unveiled at the AWS Fall Meeting in Detroit next week. Among them are a brand new concept in spotweld control and a new type of arc welding.

The spotweld control, to be discussed in a paper by G Archer of The Budd Co, Philadelphia, is based on the principle that, if the voltage across the weld is held to the correct value, the desired temperature will be produced in the weld. The control receives automatic feedback information from the weld and makes in-process corrections to compensate for variations in thickness, force, surface finish, and line voltage as well as correcting for shunting effects and wear of electrodes.

Details on the new arc-welding process will be presented by R A Wilson of The Lincoln Electric Co, Cleveland. It's a consumable-electrode process with all the welding materials—arc shield, fluxing ingredients, deoxidizers, and filler metal—contained in the continuously fed electrode. It produces welds whose mechanical properties are similar to those made by submerged-arc welding, but there is no need for additional flux or shielding gas. Welding speeds range from 150 to 300 ipm.

Another new process, electron-beam welding, is brought up to date in a paper by G Burton, Jr, and W L Frankhouser of Westinghouse Electric Corp, Pittsburgh. See "How good is electron-beam welding," p113.

ASSEMBLY

Cool Braze, Hot Remelt

A number of brazing alloys have been developed that allow relatively low brazing temperatures but result in extremely high remelt temperatures. These are a product of laboratory work undertaken at Armour Research Foundation.

The trick is turned by adding to the alloy a small amount of an element that will reduce its liquidus temperature. The experiments involved four such elements: lithium, indium, gallium, and phosphorus.

During the brazing operation, the additive vaporizes out, leaving a brazing material that will remelt only at a much higher temperature. A probable application of the new alloys is successive brazing of complex assemblies. Part of the assembly can be fixtured and brazed; then additional components can be added and brazed without softening or melting the previously brazed joints.

W M Lehrer and H Schwartzbart of Armour will present a paper on their research at the American Welding Society in Detroit, Sept 29.

It's a Third Hand

"TransfeRobot", just announced by Robodyne div of U S Industries, is a workhandling device that is practically a mechanical version of an arm and a many-fingered hand. The machine consists of a console on which is mounted a moveable arm that supports a disk with replaceable workholding fixtures. These can support such small items as cigarette

lighters, pens, or even typewriters, positioning them in turn at conventional fabricating and assembly machines arranged around the console. Riveting, crimping, stamping, and other equipment may be integrated with the mechanism. The mechanism is electronically programmed, and can be "trained" in a half hour for a new job. Cost is expected to be under $10,000 per unit.

FINISHING

Heat-Plating Process

Called Pyro-Plate, a new method of plating has been developed at Metallurgical Consultants Inc, Maywood, Calif. The process involves the application of a paint-like coating containing powdered nickel or cobalt alloys to the work which is then heat-treated in an inert atmosphere to vaporize the organic constituents and fuse the metal particles to the work.

A layer of plating material is said to become an integral part of the base metal, eliminating any possibility of peeling, chipping, or flaking. It can be applied to virtually any ferrous or nonferrous metal and is said to cost less than electroplating.

The plating compounds can be applied to virtually any thickness, adhere readily, and require no special pre-treatment of the work, except ordinary cleanliness. Internal surfaces are readily plated, provided they can be reached by brush, spray, or dip, and surfaces not to be plated may be masked. By varying the composition of the compounds, it is possible to obtain coatings with special properties.

Cutting tools, shear blades, marine hardware, high-tensile bolts, and pole-line components are among the parts to which the process has been applied.

MATERIALS & COMPONENTS

Low-Temperature Alloy

ALCO metallurgists required a material for the SM-1A reactor vessel, steam generator and pressurizer, which are designed to hold system pressures of 1500 psi and will operate at 1200 psi, to withstand the dangers of shock during shipment across Alaska. In temperatures reaching –50 F, impact resistance is a major consideration. To meet the specified shock resistance of 15 ft lb at –50 F, the Latrobe Steel Co suggested adding 1 to 2% more nickel to the conventional alloy. This change, however, created a non-ASME-code material. At ALCO request, under the special ruling of Case 1255, ASME approved for nuclear work SA-350, Grade LF-1 material with 1-2% nickel.

Unusual Relay

Wedge-action contacts are the basis for an unusual relay design created by engineers at Electro Tec Corp, South Hackensack, NJ. Offering 100,000 (minimum) operating cycles at rated load, many relays have operated to well over a million cycles without failure. Whether functioning in normal operation or under 100 g shock or 5 to 2000 cps vibration at 30 g's, the company claims that no measurable contact bounce is present. Similarly, ambient temperature exposures over a range between –65 F and 200 F do not affect its operation. The price of the relay is such that it might readily be useful in machine-tool control, even though it was developed for military electronic applications. Without the solenoid, the device might prove reliable as a limit switch.

MANUFACTURING CONTROL

Year-Round Mower Production

A 12-month manufacturing schedule for a seasonal product? That's the goal of the Pennsylvania Power Mower and ACCO Power Products Div of American Chain & Cable Co. In the past, factory workers averaged only 30 to 33 weeks of work per year. The new work-all-year plan should double take-home pay.

Here's the company's plan: For several months of the year, it will concentrate on the production of mower parts and components; during the remainder of the year it will concentrate on final assembly and shipping to distributors.

To put the plan into effect, the company has streamlined operating procedures, also embarked on a program to standardize components in its power mower line. With the plan in effect, and with existing equipment, plant can produce more than 3500 mowers a day.

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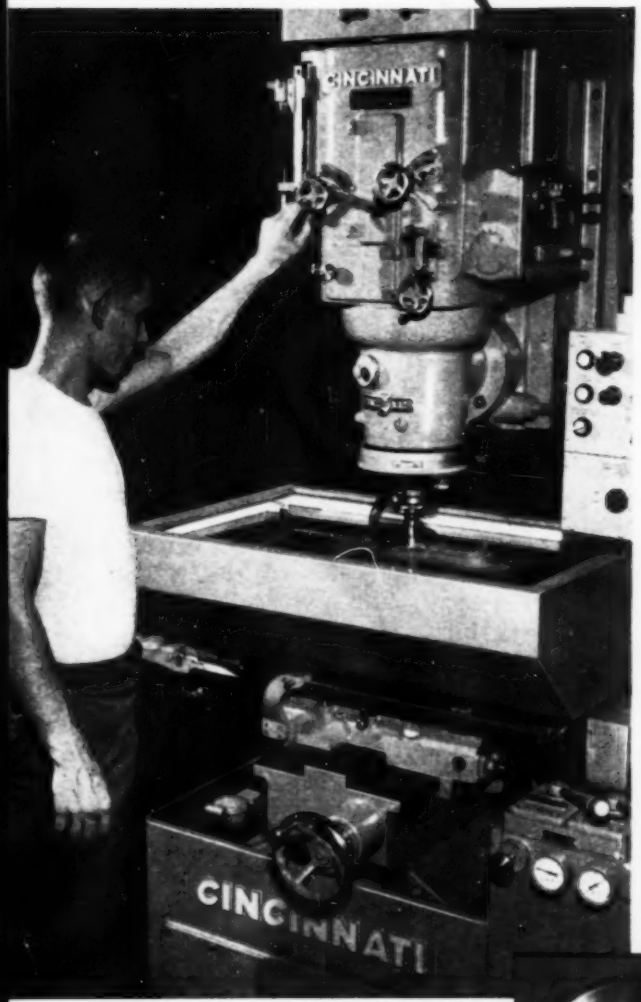
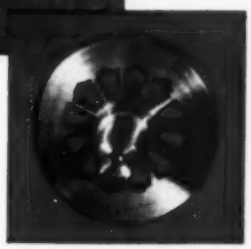


Opportunities to reduce costs now are more numerous than ever before. Consider electrical discharge machining (EDM), for example, a method which is impartial to hardness of the work, to complexity of the machined surface, to fragility of the work. A new line of Elektrojet EDM Machines, recently introduced by Cincinnati, greatly extends the possibilities of the method.

In developing this new line of machines, Cincinnati recognized the importance of sturdy machine tool construction. The reasons may not be obvious. As a machining process, EDM is inherently accurate. Cincinnati's machine tool approach makes sure that the full degree of accuracy is obtained. Another reason for heavy construction is the force created by electrical discharge machining of large areas, which is comparable to that of chip-making machines. Dielectric pressure (about 10 psi) multiplied by the area of machined surface results in very appreciable forces.

Other Elektrojet advantages include Cincinnati's long experience in hydraulics and servo controls; the Elektrojet customer service laboratory, where you can determine the value of EDM for your work; and the Elektrojet specialists, who have a machine tool background second to none. Additional information will be found on the two following pages. **Milling Machine Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.**



• **SILENTLY AND WITH BUT TOKEN ATTENTION,** Elektrojet electrical discharge machining works quickly and efficiently to perform operations which are impossible or too expensive for other machines. The example shown at the right is a small missile part made of pure beryllium, ⅞" major diameter. In just five minutes twelve triangular-shaped holes are electrical discharge machined simultaneously.

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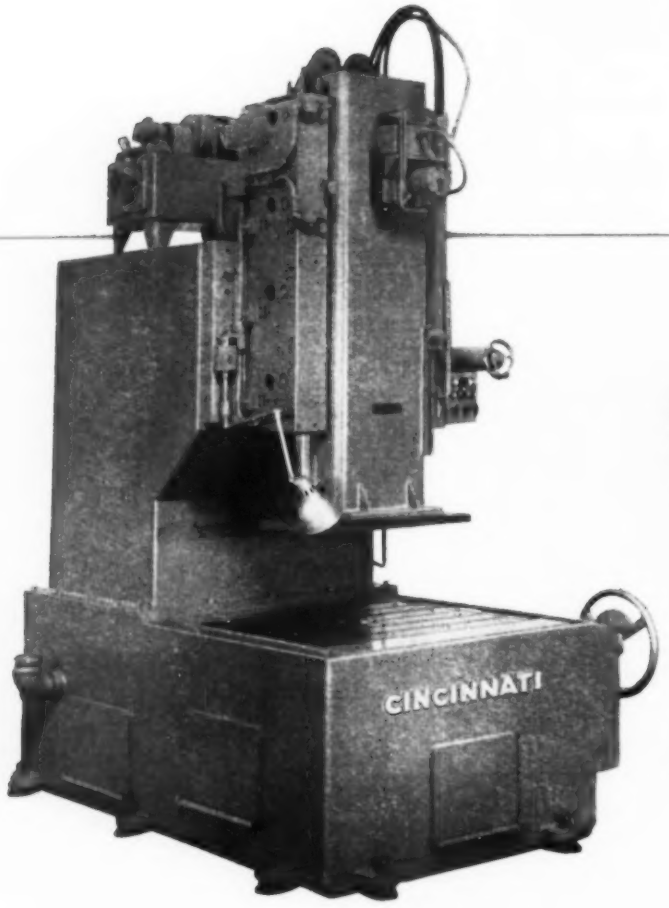

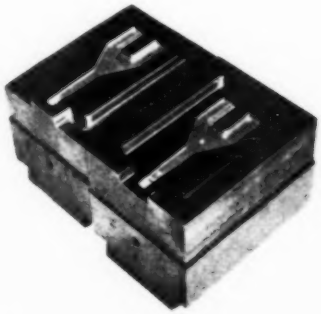

NO. 3 ELEKTROJET. This machine has the capacity for large heavy work, like the 15" long dies illustrated here.

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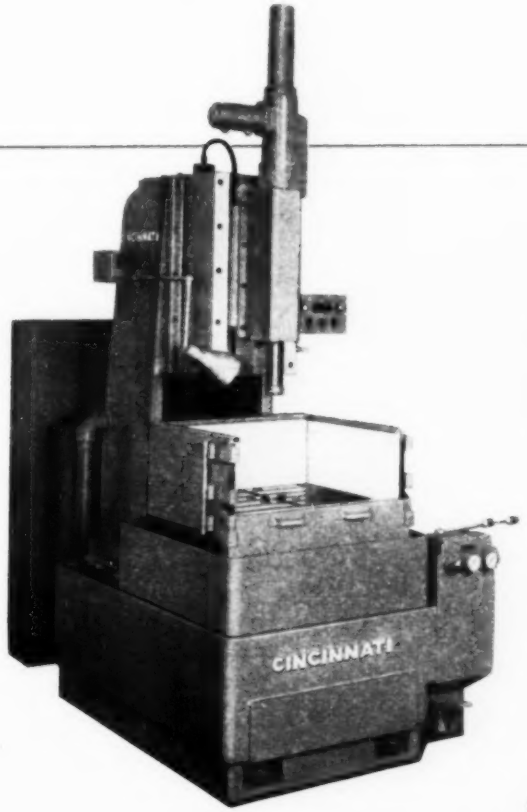
Four styles of workheads are available: non-rotating, rotating, ram-type and universal. For all of them, a servo feed unit maintains proper gap between electrode and work to assure maximum efficiency of metal removal. Other beneficial features: two styles of work tables, fixed or adjustable . . . four styles of dielectric tanks, solid, open front, disappearing or moving table . . . a selection of power supply units.

There are many other reasons why Elektrojet engineering and machines are the finest. Folder M-2077 contains the complete story. Write for a copy.



No. 1 ELEKTROJET with non-rotating workhead. Typical work is the extrusion die shown above, about 2⅞" outside diameter. Operation, EDM gear teeth through center.

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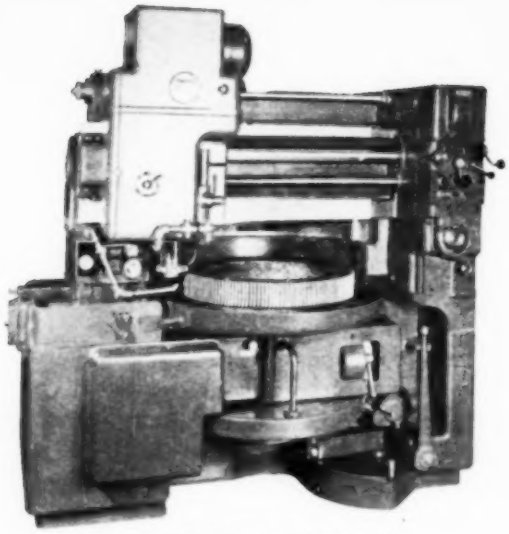
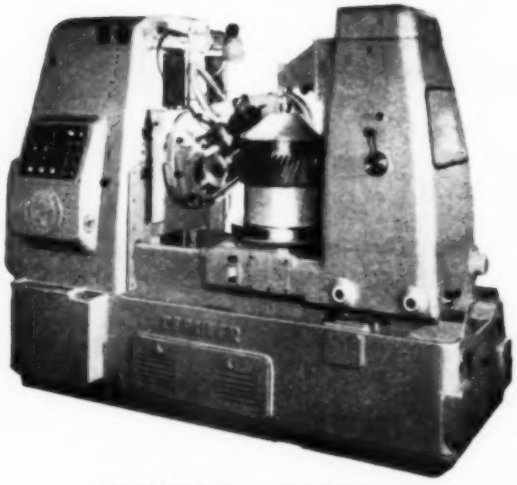
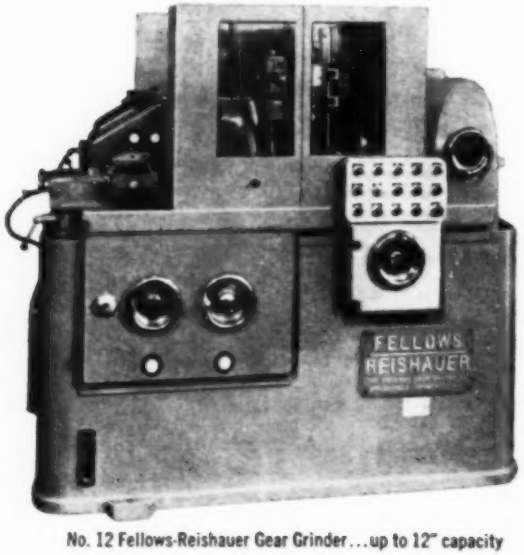
SHAPE IT, HOB IT, OR GRIND IT! ONLY FELLOWS OFFERS ALL 3 MACHINES!



Fellows Gear Shapers... up to 120" capacity



Pfauter Gear Hobbers... up to 120" capacity



No. 12 Fellows-Reishauer Gear Grinder... up to 12" capacity

WHATEVER YOU NEED for modern gear productivity, Fellows has the equipment to keep you in the competition! In addition to Gear Shapers, and all other Fellows equipment from cutters to inspection instruments, Fellows now sells the No. 12 Fellows-Reishauer Gear Grinding Machine and the complete line of world-famous Pfauter Gear Hobbers! Fellows Gear Shapers and Pfauter Gear Hobbers provide outstanding accuracy and high production speeds, on short runs as well as long runs, for a wide range of gears up to 120" P.D. On all but the larger units, a wide range of attachments is available for semi-automatic or fully automatic operation. Runout tolerances measured in tenths, produced at production line speeds, are the special province of the No. 12 Fellows-Reishauer Gear Grinding Machine. Simple, fast set-up permits economical grinding of single gears as well as long runs in sizes up to 12" O.D. Ask your Fellows Representative about the complete line of gear production and inspection equipment. Just write or call any office of The Fellows Gear Shaper Company, 78 River Street, Springfield, Vermont. Branch Offices: 1048 N. Woodward Ave., Royal Oak, Michigan.; 150 W. Pleasant Ave., Maywood, New Jersey; 5835 W. North Ave., Chicago 39, Illinois; 6214 W. Manchester Ave., Los Angeles 45, California.

FELLOWS GEAR PRODUCTION EQUIPMENT

THE PRECISION LINE

HOW DO YOU MEASURE

GROWTH?

Increased plant size is certainly one sure indication. The Landis Machine Company began operations in 1903 in a building having only 7600 square feet of floor space—represented by the color area.

Today, by comparison, the plant is a sprawling giant measuring nearly 400,000 square feet of floor space. In addition, the Landis plant in Canada includes 10,900 square feet. During the last 6 years we have continued to grow—through building 40,000 square feet of additional facilities in Waynesboro—the purchase of Maiden and Company, Ltd. in England—and an immediate expansion of 17,000 square feet at Maiden.

But mere physical size is not the only indication of growth. There are other indications, perhaps less tangible, but just as important. Maturity is one. Sincerity is another. And maybe the most important of all is Responsibility.

Landis is proud that it has "grown-up" not only in ways that show in figures and statistics, but also in ways that show in a friendly smile, a sincere hand-shake, and the willingness to accept the responsibility for customer satisfaction. These non-statistics are just as important to the people at Landis as graphs and charts; and, for over 50 years, they've proved to be important to our friends and customers.

For assistance or information on any phase of threading production or equipment, call or write Landis—The World's Largest Manufacturer of Threading Equipment.

LANDIS *Machine* COMPANY
WAYNESBORO • PENNSYLVANIA
THE WORLD'S LARGEST MANUFACTURER OF THREADING EQUIPMENT

Thread Rolling Machines

Thread Rolling Tools

Centerless Thread Grinding Machines

Taps—Collapsible & Solid Adjustable

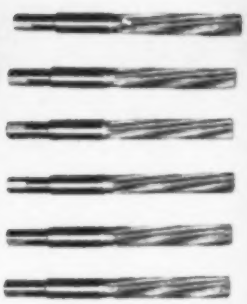
Die Heads—Rotary & Stationary

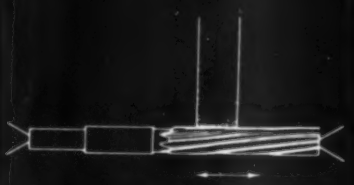
Threading Machines

556C

Production increased 90%

New Landis 4" x 18" type H Plain Grinder





production data

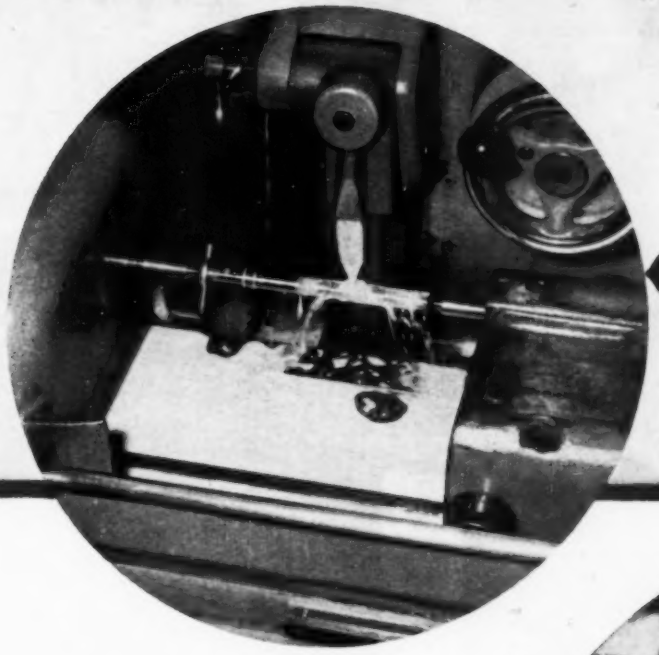
Machine:	New Landis 4" x 18" type H Plain Grinder
Part:	Standard size reamer
Operation:	Grinding standard size reamers to selective sizes
Production:	35 per hour roughing 105 per hour finishing
Material:	High speed steel
Hardness:	61-63 Rockwell C
Stock removal:	Rough—.012"-.014" Finish—.001" with 12 to 18 RMS finish
Tolerance:	.0001"

Landis 4" x 18"
type H Plain Hydraulic Grinder

LANDIS TOOL COMPANY

grinding reamers

replaces old machine, cuts grinding costs



Close tolerances of .0001" are consistently maintained grinding the flutes of these stock reamers to selective sizes.

Stock removal is fast, and sizes accurate with this compact Landis grinder. Convenient Landis eye-level wheel feed makes selective size adjustments fast and accurate.

WAYNESBORO, PENNSYLVANIA

LANDIS
precision grinders

new
Most
Productive
and
Versatile
Drill-Point
Grinder
Ever
Designed

MORSE

Production

DRILL-POINT GRINDER

Now . . . you can accurately grind points on a profitable, high-production basis.

This new machine, conceived and built by Morse . . . has been thoroughly job-proved in the Morse plant. In fact, this one compact unit, with its attachments, will grind the following points . . .

CONVENTIONAL

HELI-CENTRIC

and **SPLIT POINT...**
(CRANKSHAFT)

on a high-precision, high-production basis. No other machine can match this performance.

For complete details, write for new illustrated bulletin.

MORSE TWIST DRILL & MACHINE CO., NEW BEDFORD, MASS.

Warehouses in New York, Chicago, Detroit, Dallas, San Francisco.

VN *A division of Van Norman Industries, Inc.*

MORSE *means* **"THE MOST"** *in Cutting Tools*

CIRCLE 164 READER SERVICE CARD

CIRCLE 165 READER SERVICE CARD ►

NEW

WARNER & SWASEY

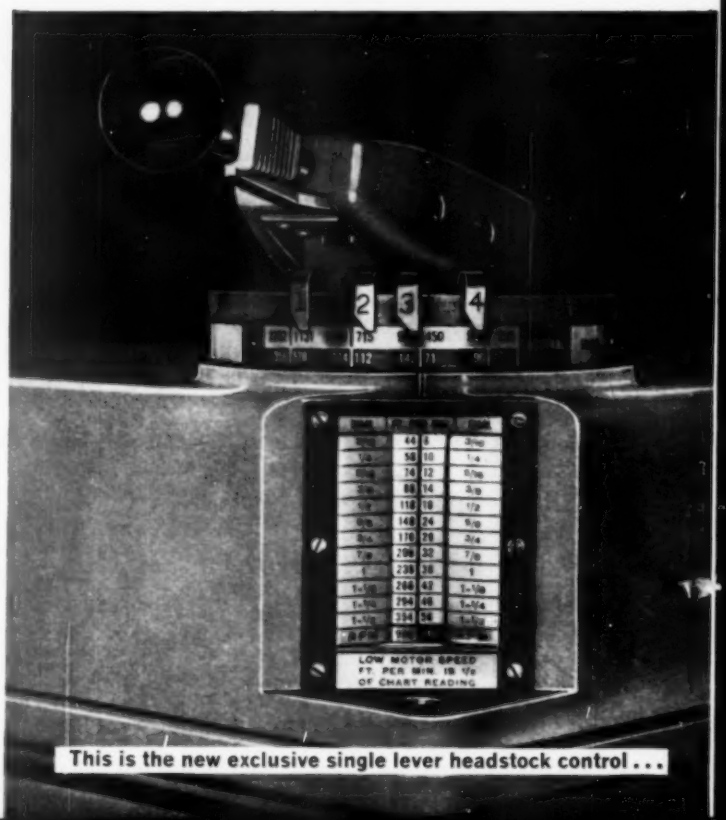
Unique, Automatic Headstock

More Speeds – Greater Range –The new eight-speed headstock (16 with a two-speed motor) gives you more speeds in a wider range – from 45 to 2262 rpm – for maximum metal removal efficiency.

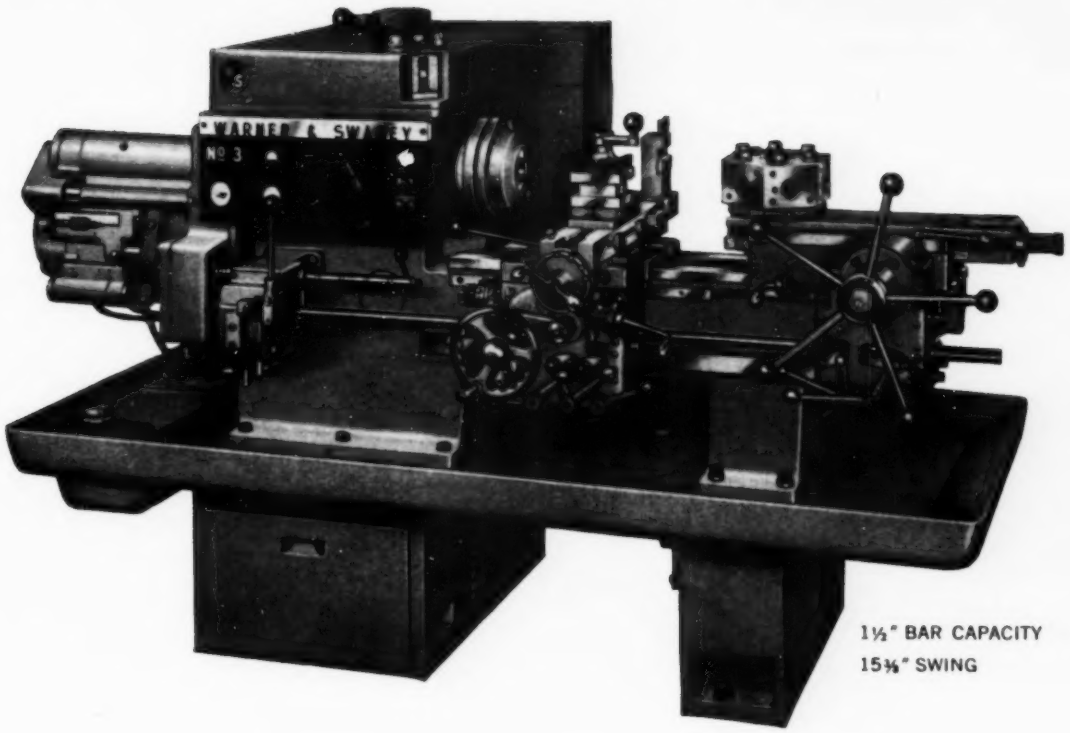
Instant Speed Changes throughout the full range are made possible through exclusive, Warner & Swasey designed direct-acting hydraulic clutches (which never need adjustment) in combination with a constant mesh, helical gear train. Time loss for gear shifting in conventional headstock gear trains is eliminated.

Full Power is always available at the spindle nose by the higher-powered, direct-mounted motor. Direct mounting also eliminates motor-drive maintenance problems.

New, Rugged Bar Feed and Collet Chuck are hydraulically operated with single-lever control for easy, fast handling. The wider base and rigid construction of the bar feed permits greater accuracy and smoother work finishes on high-speed, heavy-duty work.

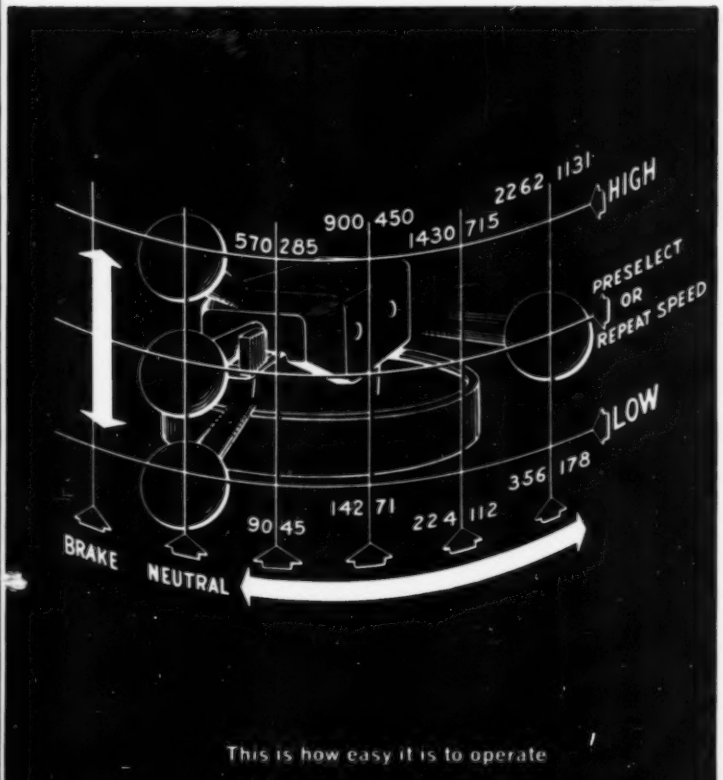


This is the new exclusive single lever headstock control . . .



1½" BAR CAPACITY
15¾" SWING

No.3 ram type turret lathe



This is how easy it is to operate

Exclusive, Single Lever Preselector and Speed Control

Control of spindle speeds is now an easy one-hand operation on the new No. 3! Preselection of speeds, speed change, brake and neutral—all are obtained with the same lever!

No fumbling for speeds... no gear shifting. Just rotate the handle to preselect; move it up or down to engage new speed instantly.

No figuring... the direct reading preselector dial tells you the surface speed for each diameter and rpm.

No remembering (or forgetting)... the preselector drum lets you set up the sequence of cuts; numbered clips tell you where to find the speeds and their order of use.

Neutral (free spindle) and Brake are selected by rotating lever to the left.

Forward and Reverse are controlled by a switch lever on front of headstock.

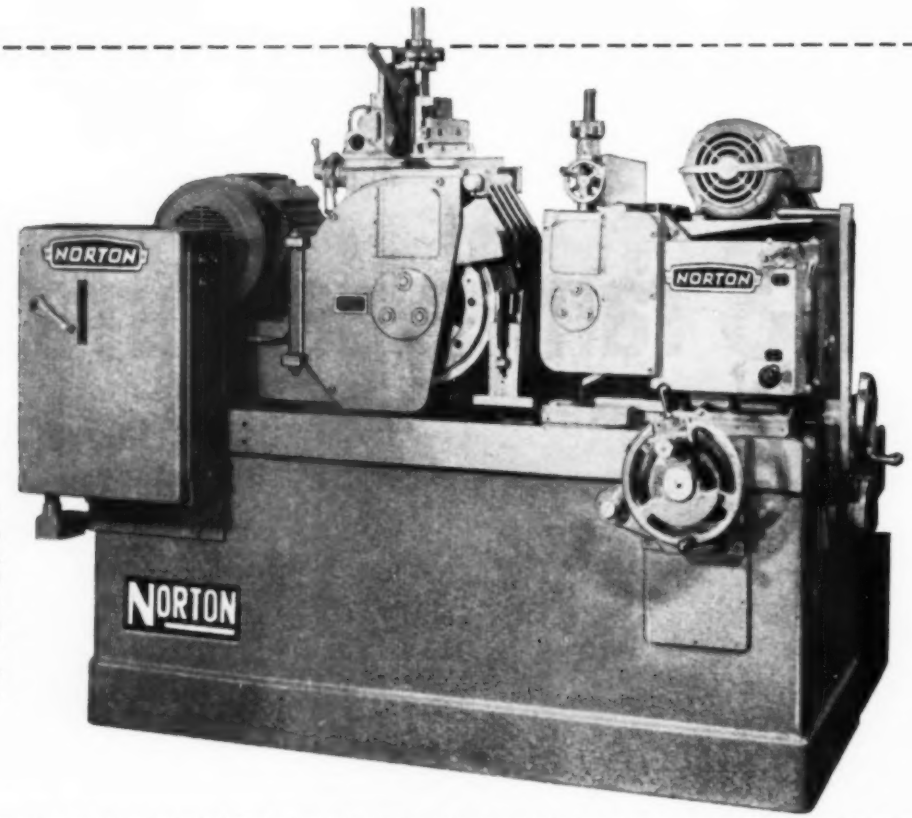
For free brochure write Warner & Swasey Company, Cleveland 3, Ohio.

You can produce it better, faster, for less... with a WARNER & SWASEY

Newest NORTON Grinder!

The No. 2 Straddle-Bearing

Centerless is built for speed . . .

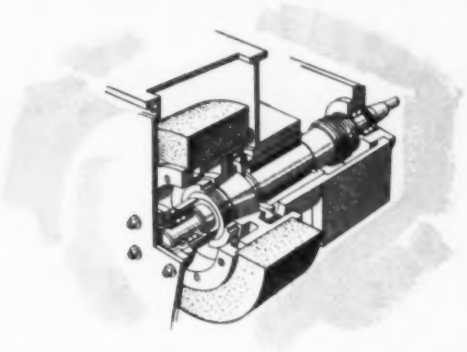


Ready for Immediate Delivery
The new Norton No. 2 Centerless Grinder can be arranged for full automatic, semi-automatic or manual thru-feed or plunge grinding. Capacity includes work diameters ranging from 1/16" to 4¾" depending on type of work rest and bar grinding fixture.

◀ CIRCLE 166 READER SERVICE CARD

▲ CIRCLE 167 READER SERVICE CARD

3 MAJOR ADVANCEMENTS IN CENTERLESS GRINDING



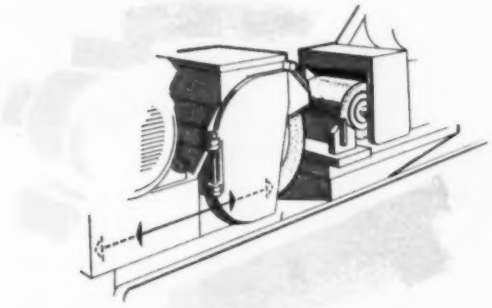
accuracy . . . economy

Straddle-Bearing Spindle Support, in both grinding and regulating wheels, provides extra strength. Combined with the inherent rigidity of Norton spindles this boosts capacity to take heaviest cutting pressures, while permitting fast grinding to close tolerances under all conditions.

Like all Norton grinders and lappers the Norton No. 2 *Straddle-Bearing* Centerless Grinder is built to deliver "Touch of Gold" performance — the Norton extra that adds value to your product while cutting your production costs.

You'll find plenty of proof of that in the modern construction of this newest machine of its type. *Straddle* support of spindle bearings adds strength and ability to take tough jobs . . . the mobile wheel head and constant work-loading alignment make jobs shorter and easier.

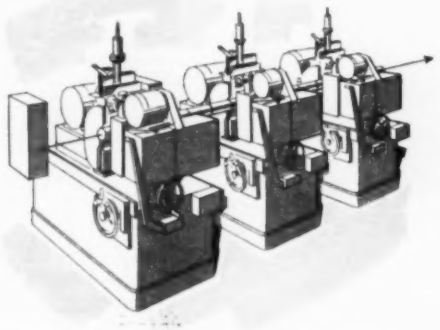
Many other features result in outstanding performance advantages. Call your Norton Sales Engineer, a trained expert in the grinding field, for consultation on how these features can benefit your production. Or write for Catalog 1328. NORTON COMPANY, Machine Division, Worcester 6, Mass.



Mobile Grinding Wheel Head, with wheel mounted between head ways and feed screw located beneath wheel center for ideal balance, provides instant response to signals. This results in especially fast sizing, one of many important advantages over fixed head operation.

NORTON
GRINDERS and LAPPERS

District Offices: Worcester, Hartford, Cleveland, Chicago, Detroit.
In Canada: J. H. Ryder Machinery Co. Ltd., Toronto 5.

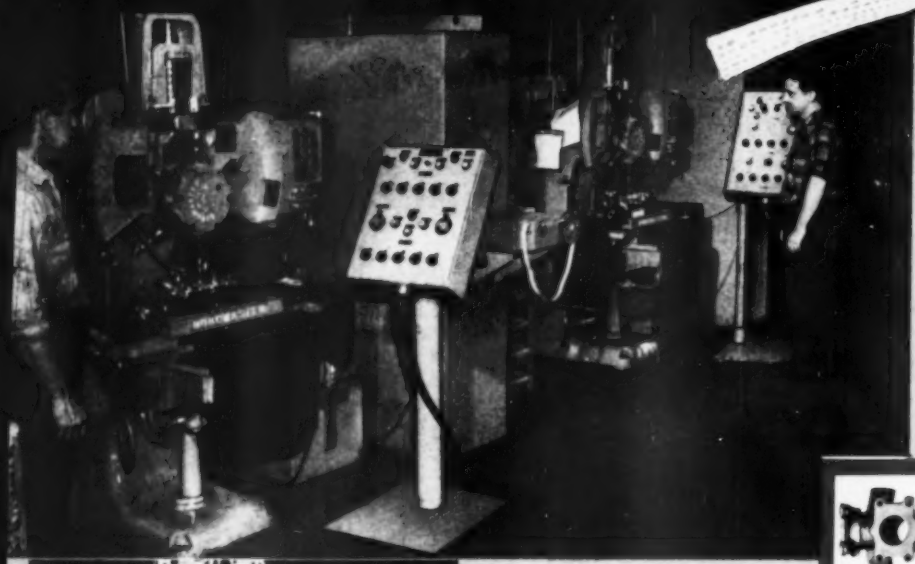


Work Loading Alignment is never disturbed by wear of either grinding or regulating wheel . . . neither is the alignment of the work rest blade. Movable heads for both grinding and regulating wheels make this advantage possible . . . and especially time-saving in a battery set-up.

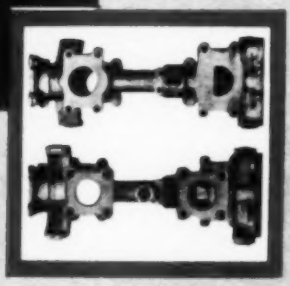
Making better products . . . to make your products better
NORTON PRODUCTS: Abrasives • Grinding Wheels • Grinding Machines • Refractories • Electro-Chemicals — BEAR MANNING DIVISION: Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

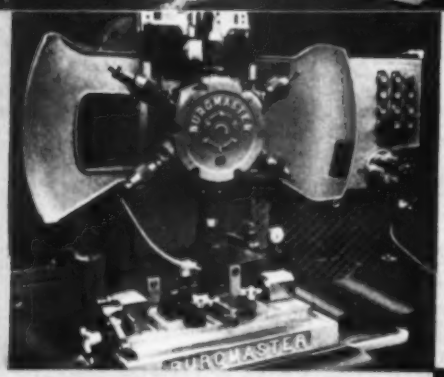
Stainless Steel Valve Body

BURGMASTER *tape controlled*



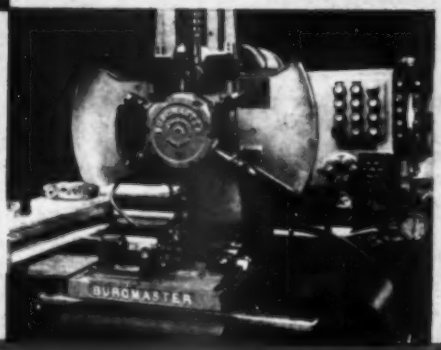
#347 Stainless Steel Valve Bodies now machined on Automatic Tape Controlled Burgmasters to far better than the required ±.002" tolerances. Former time was 2.7 hours. Present time is ½ hour.





1st operation showing the simple quick clamping fixture, and tooling required to perform 32 precision drilling and c'boring operations.

2nd operation showing simple Fixture and tooling used to perform 27 drilling and reaming operations.



World's Largest Builder of Turret Drilling Machines

"O" Manual Power Index ¼" Capacity

1C Manual Power Index ⅜" Capacity

2B Manual Power Index ⅜" Capacity

2BF Flange Mounted Power Index ⅜" Capacity

2BH Automatic Hydraulic ⅜" Capacity

3BH Automatic Hydraulic 1½" Capacity

2BR Ram Type Radial Drill ⅜" Capacity

2BHT-3BHT Automatic Tape Controlled ⅜" and 1½" Capacity

Production Increased 440% with...

6 SPINDLE TURRET DRILL

(at Standard-Thomson Corp., Waltham, Mass.)

Two Burgmaster G. E. Tape Controlled 6 Spindle Turret Drilling Machines used for machining #347 Stainless Steel Valve Bodies at Standard-Thomson Corporation, Clifford Mfg. Co. Division, Waltham, Mass. have increased production 440% as compared to a multiple drilling set-up using dowel location holding fixtures. The valve jobs are now machined in 2 set-ups (one per machine) and a total of 59 operations including drilling, c'boring and reaming are automatically performed in ½ hour rather than the former time of 2.7 hours.

The machines were purchased expressly for this job although they will also be used for other work. "The repetition of controls has been perfect, and dimensions are held far beyond the required tolerance."

MAXIMUM FLEXIBLE AUTOMATION is obtained from Burgmaster 6 and 8 spindle Turret Drilling, Tapping and Boring machines because they can be quickly and economically set up to produce a large variety of parts using standard tools and simple work holding clamps.

The standard adjustable Burgmaster controls are maintained...including pre-selective spindle speeds, infinitely variable pre-selective feeds, slective rapid approach and return, skip indexing, precision depth control, and simple manual controls for set-up. The G. E. numerical system controls all machine functions, selects spindles in any sequence, automatically positions the table on two axes, clamps the table while machining operations are performed, and controls coolant. Up to 6 or 8 different operations can be performed at any command position without moving the table, or as many cycles using one tool as desired, without indexing. All operations are carried out at their most efficient rate for high finish, precision, speed, and longest tool life. As a result one man can operate two or more machines on many jobs, or by attaching two tapes together one part can be machined on one end of the table while work is being set up on the other to effect constant machine operation.

Whether your work is small lots or high production you can obtain exceptional savings and production increases with Burgmaster Tape Controlled Turret Drills. Our representatives will be glad to discuss this possibility on your work with you, at no obligation. Just call.

JOB FACTS

Machines: Two Burgmaster Tape Controlled Turret Drills.
Parts: Valve Bodies #347 Stainless Steel
Lot Size: 50
Holding Fixtures: Simple quick acting clamps
Operations: 59 — C'Drilling, Drilling, C'Boring and Reaming
Accuracy: ±.002" required
Former Time: 1st operation — 1.2 hours
2nd operation — 1.5 hours
Total: 2.7 hours
Present Time: 1st operation — .17 hours
2nd operation — .33 hours
Total: .5 hours
Savings: 2.2 hours
Production Increase: 440%
Other Advantages: Far better accuracy than required; repetition of controls has been perfect.

Write for Bulletin describing Burgmaster 6 and 8 Spindle Tape Controlled Turret Drilling, Tapping, and Boring Machines. Thirty-minute 16mm sound film showing all Burgmaster Turret Drills in operation is available from any office without charge.

BURG TOOL
MANUFACTURING COMPANY, INC.
15001 South Figueroa Street, Gardena, California
FAculty 1-3510 DAvis 9-4158

BURGMASTER

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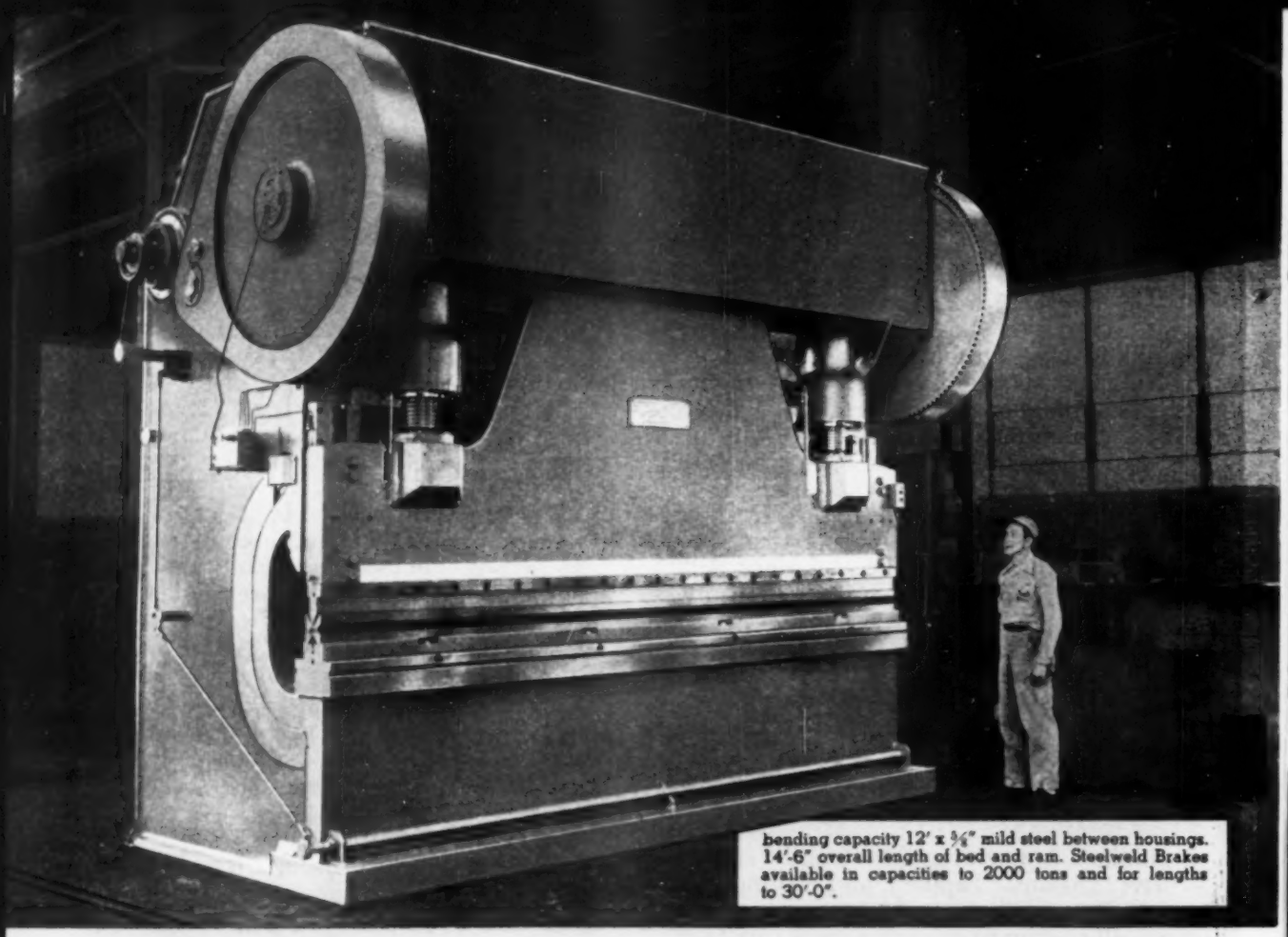
Plus dealer representatives in other industrial centers.

CIRCLE 170 READER SERVICE CARD



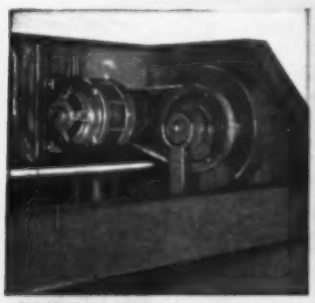
bending capacity 12′ x ¾″ mild steel between housings. 14′-6″ overall length of bed and ram. Steelweld Brakes available in capacities to 2000 tons and for lengths to 30′-0″.

BRAKES and SHEARS BUILT

STEELWELD machines are built to withstand the rigors of mass-production high-speed work, as well as meet the needs of jobbing shops requiring frequent set-up changes. They are liberally designed throughout to assure maximum service with minimum maintenance. A wide array of desirable features are provided, some of which are not available elsewhere.

Steelweld Brakes and Shears are easily adapted for special requirements. Our engineers will be glad to work out design changes to speed production, improve safety or bring about other advantages for specific applications.

A Few of the Outstanding Press Brake Features



SW-309

Long Life Clutch and Brake

Heavy construction assures long trouble-free life. Clutch unit is duplicate of brake and parts interchangeable. Adjustments easily made without tools.

SW-438

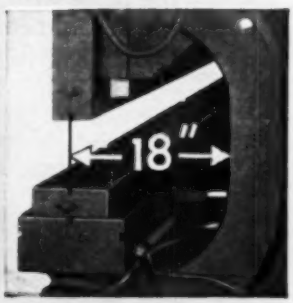
Slides Compensate For Wear Automatically

V-shaped slides and guides eliminate loose gibbing. Take up wear automatically. Easily removed and replaced.

SW-304

Six Large Main Bearings

Each of the two eccentric shafts which drive the ram has three heavy bronze bearings. Ram adjustment is made by revolving nut. Screws do not turn; therefor, ball joint wear is reduced.

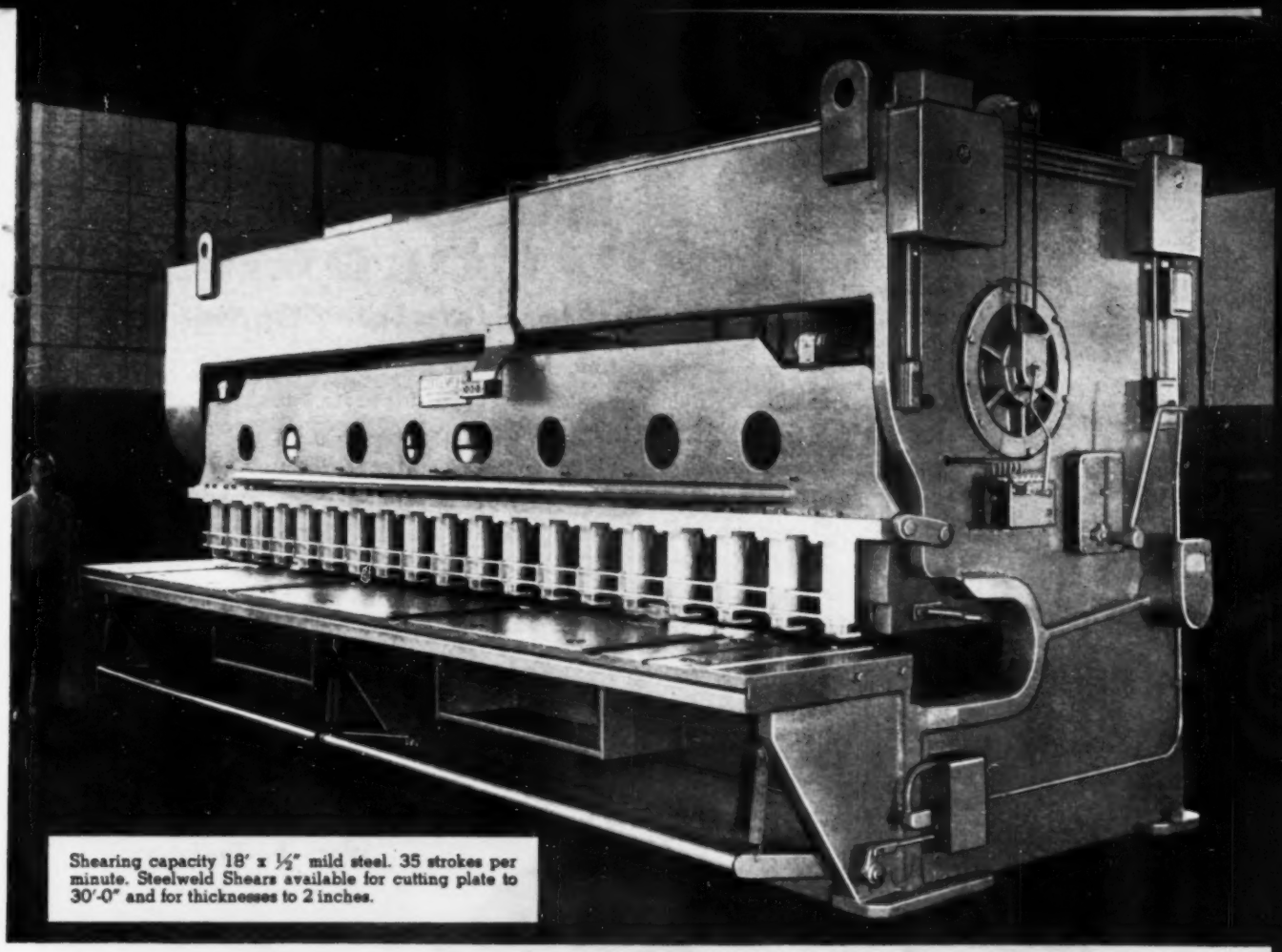


SW-441

Extra Deep Throat

18-inch throat is standard on all Steelweld Brakes. This permits making bends to 18 inches from edge of plate for full length of dies.

CIRCLE 171 READER SERVICE CARD



Shearing capacity 18' x ½" mild steel. 35 strokes per minute. Steelweld Shears available for cutting plate to 30'-0" and for thicknesses to 2 inches.

FOR **HEAVY DUTY** SERVICE

Many Important Shear Advantages

1. Pivoted blade operation.
2. No slides or guides to wear.
3. Knife clearance easily adjusted to suit plate thickness.
4. Smooth, sharp accurate cuts.
5. Low rake.
6. Negligible twist, camber and bow in cut pieces.
7. Fast cutting and high production.
8. Easy and simple to operate.
9. Convenient electric foot control.
10. Trouble-free mechanical hold-downs.
11. Easily arranged for squaring, slitting and notching.
12. Convenient, accurate, ball-bearing mounted back gauge.
13. Quiet operating.
14. Designed for safety throughout.
15. Long knife wear between grindings.
16. Knives easily removed and replaced.
17. All-welded one-piece frame with bed integral.

GET THESE BOOKS!

Catalogs No. 2010 (Brakes) and No. 2011 (Shears) give construction and engineering details. Profusely illustrated.

THE CLEVELAND CRANE & ENGINEERING CO.

1457 EAST 282ND ST. WICKLIFFE, OHIO

STEELWELD

BRAKES and SHEARS

CIRCLE 172 READER SERVICE CARD

ARMSTRONG
TOOL HOLDERS

A Correct Tool for Every Lathe Operation

You can save time (and money) by ensuring that your machine tools are equipped with *adequate numbers* of the correct ARMSTRONG Tool Holders. The ARMSTRONG System of Tool Holders includes correctly designed tools for *every* standard operation on lathes, shapers, and planers, and for many operations on turret lathes and screw machines. By utilizing the ARMSTRONG System of Tool Holders, you can reduce tooling costs, eliminate down time in tooling up, operate your machine tools at maximum feeds and speeds.

ARMSTRONG Tool Holders are long-lasting tools. They are strong beyond need, handy and efficient, profitable to use, and are readily available from your local ARMSTRONG Distributor.

Check over your ARMSTRONG Tool Holder needs.
Write for literature.

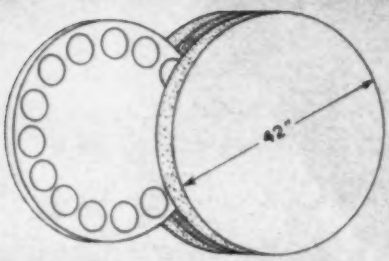
If you do not know the name of your local ARMSTRONG Distributor, inquire when asking for literature.

ARMSTRONG BROS. TOOL CO. 5215 W. ARMSTRONG AVE. CHICAGO 46, ILL.

new Gardner 2H40 precision disc grinder

larger discs . . . more power . . . greater capacity

40 hp drives
42″ discs



Rotary work carrier is illustrated. 2H40 is also available with thru feed or gun type fixturing.

New 2H40 Double Spindle Precision Disc Grinder

Greater accuracy—increased travel between larger discs improves flatness and parallelism.

Higher productivity—as much as 75% greater for parts over 6″ in diameter compared to 30″ disc grinder.

surface grinds **TWO** sides parallel in **ONE** operation

GARDNER

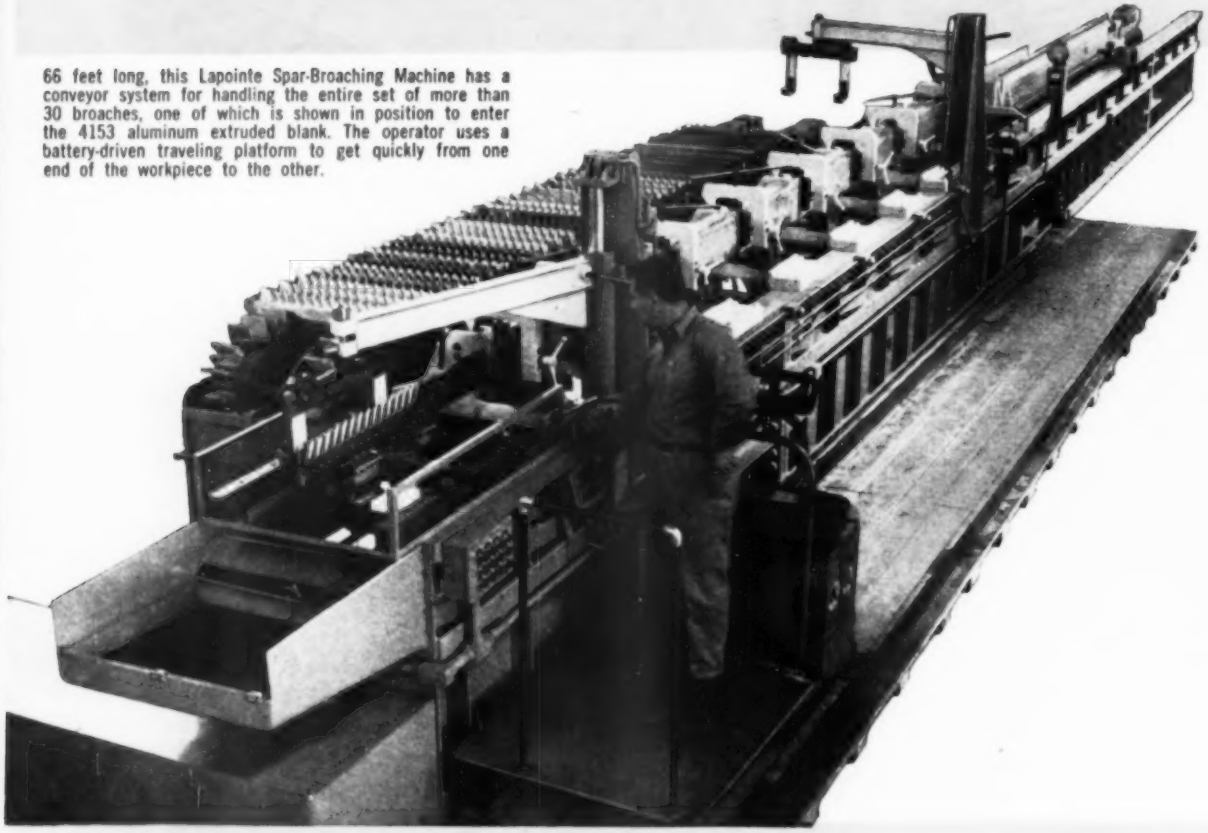
precision disc grinders

BELOIT, WISCONSIN

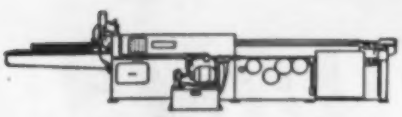
The longest hole ever broached is in this 24-foot helicopter blade

...and it's broached on the LAPOINTE SPAR-BROACHING MACHINE with 340-inch stroke

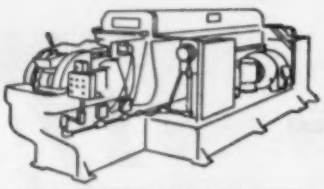
66 feet long, this Lapointe Spar-Broaching Machine has a conveyor system for handling the entire set of more than 30 broaches, one of which is shown in position to enter the 4153 aluminum extruded blank. The operator uses a battery-driven traveling platform to get quickly from one end of the workpiece to the other.



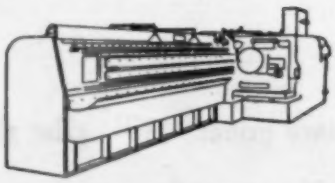
Lapointe-built Broaching Machines are available in hydraulic and electro-mechanical drives.



60" STROKE HORIZONTAL, ELECTRIC



CH CONTINUOUS BROACHING, ELECTRIC



SRHE SINGLE RAM HORIZONTAL, ELECTRIC

Having completed its pass, this broach is being returned to the conveyor system. The building-block principle on which this Lapointe Spar-Broaching Machine is designed will permit the broaching of much longer spars, by adding more sections. The machine has a capacity of 50 hp. Its electro-mechanical drive provides a steady pull, and this chatter-free broaching produces a finish of better than 50 micro-inch.

Everybody seems to come to Lapointe when in need of help on unusual broaching problems. And broaching the inside contour of the 24-foot extrusion was a *real problem* . . . it had never been done before.

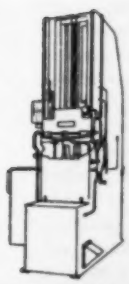
Now that it has been done, the all-metal spar is destined to replace the conventional fabricated spar and provide many production and structural advantages, including much longer life of the spar.

Maybe your shop is producing a part that could be improved by broaching — or perhaps the production time could be substantially reduced. Why not find out? An experienced Lapointe Field Engineer will gladly discuss any metal-removing problem with you.

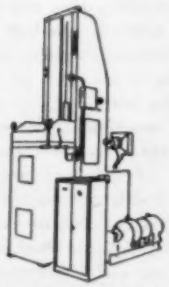
THE LAPOINTE MACHINE TOOL COMPANY

HUDSON, MASSACHUSETTS • U.S.A. *In England: Watford, Hertfordshire*

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES



VUE-7 VERTICAL PULL-UP ELECTRIC



SRVE SINGLE RAM VERTICAL, ELECTRIC

DRVE DOUBLE RAM VERTICAL, ELECTRIC

LAPOINTE

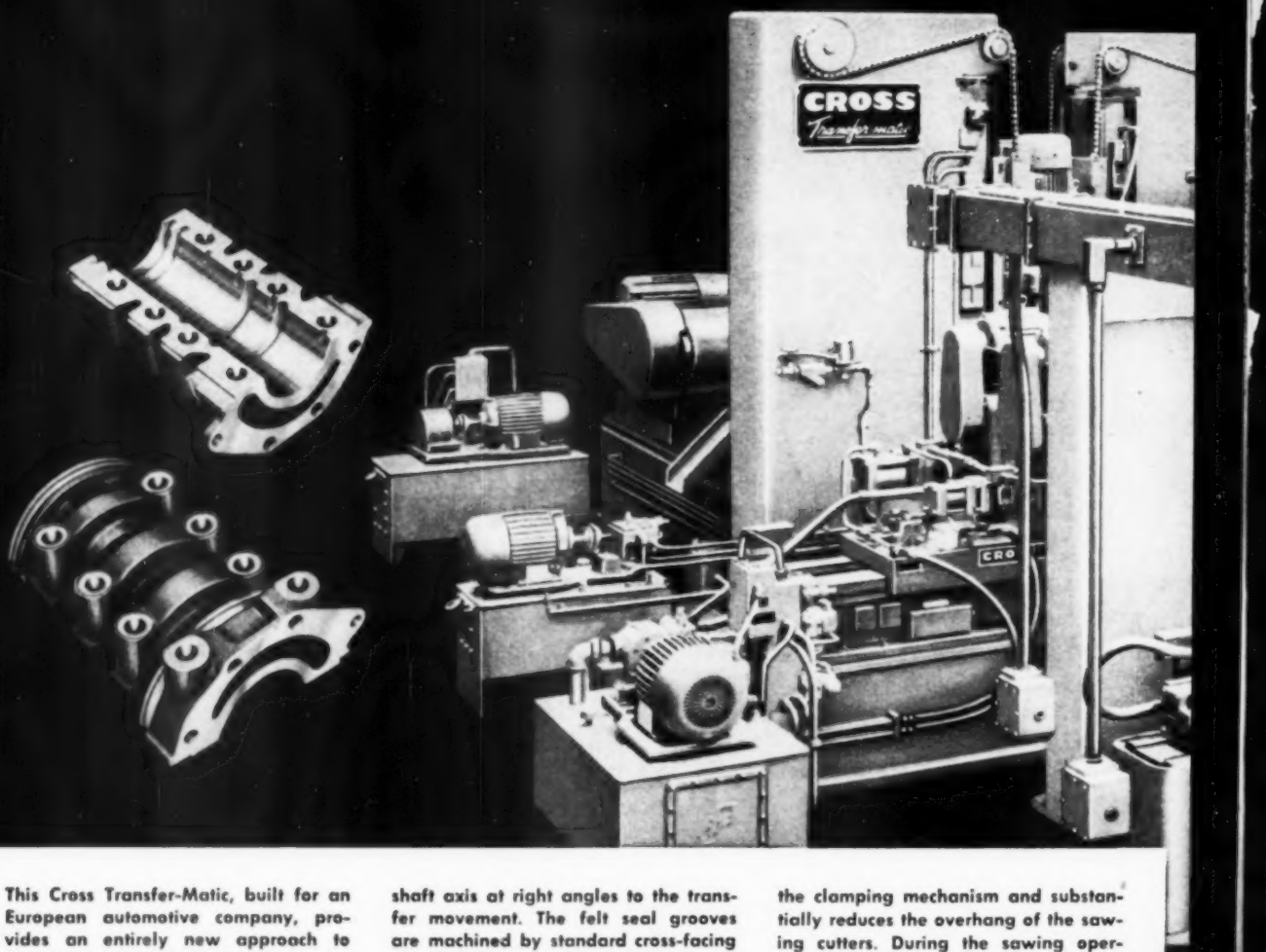
known to be the best in

BROACHING

CIRCLE 176 READER SERVICE CARD

CIRCLE 177 READER SERVICE CARD ►

A New Approach For Processing Crankshaft Bearing Caps



This Cross Transfer-Matic, built for an European automotive company, provides an entirely new approach to machining crankshaft bearing caps. Capacity of the 30 station machine is 109 sets (436 pieces) per hour at 100% efficiency.

The parts, cast in clusters of four, are broached in preparation for the operations performed by the Transfer-Matic. Unlike American designs, the No. 1 and 4 caps require felt seal grooves and the No. 1 cap has a pattern of four holes in the end for mounting a fan belt cover.

New Methods

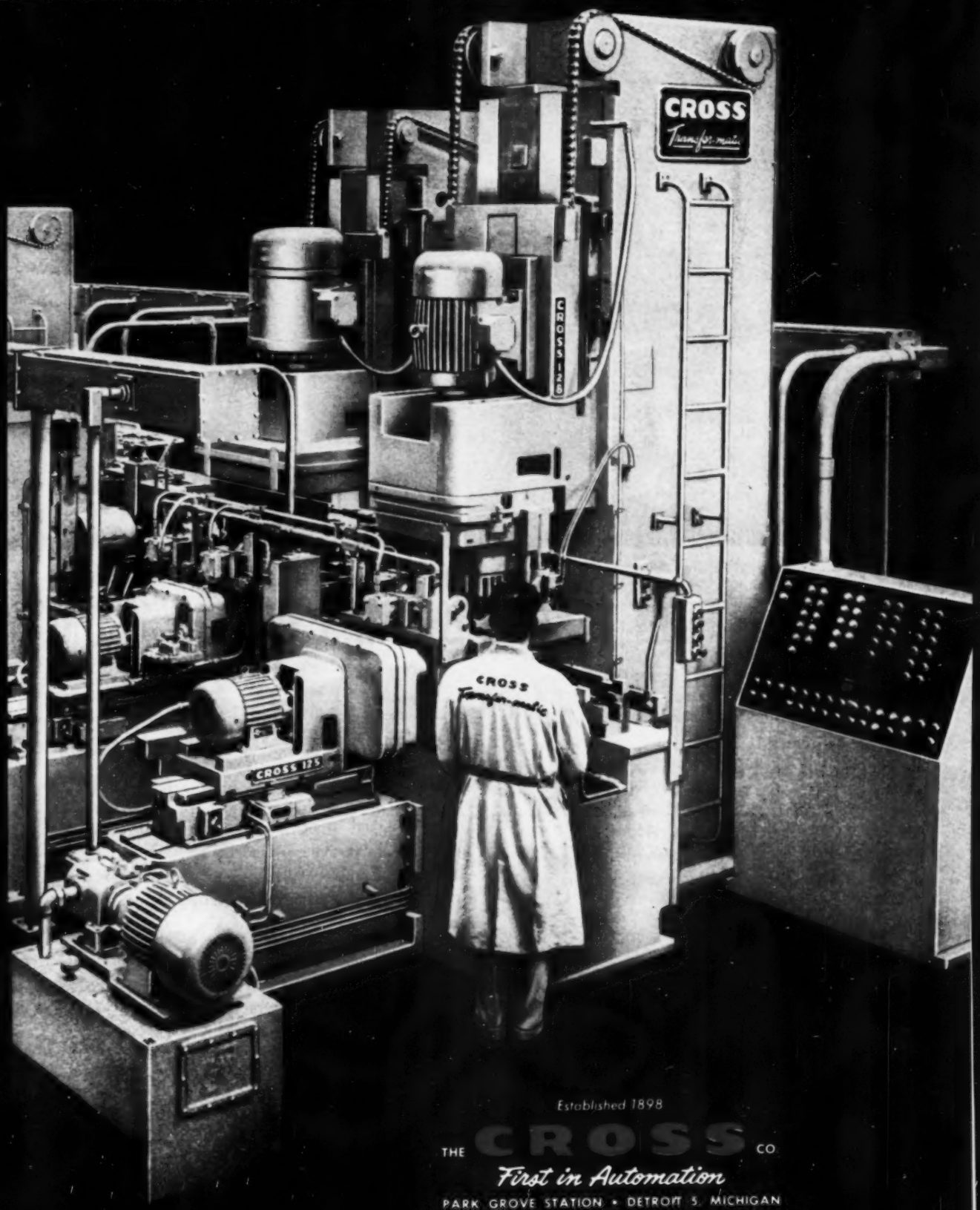
The clusters are indexed by a lift and carry transfer mechanism with the crankshaft axis at right angles to the transfer movement. The felt seal grooves are machined by standard cross-facing heads mounted on horizontal positioning units. The fan belt cover hole operations are also performed horizontally. The bolt holes, bearing lock notches, oil slinger grooves and the milling of a lug on the No. 1 bearing cap are all machined vertically.

New Sawing Unit and Fixture

At the very end of the machine, the clusters are shuttled into a special sawing fixture where they are cut into individual pieces and ejected. The fixture, a new design, holds the parts with the joint face at a 40° angle. This arrangement permits the chips to fall free of the clamping mechanism and substantially reduces the overhang of the sawing cutters. During the sawing operation, locating pins are inserted in all of the bearing cap bolt holes to provide maximum rigidity and to prevent pinching of the saws as they withdraw from the work.

The machine is constructed to JIC Standards, has complete interchangeability of all standard and special parts, and is constructed out of standard Cross building blocks for optimum flexibility. A Cross Machine Control Unit equipped with Toolometers programs tool changes to reduce machine downtime. All tools are pre-set in standard Cross tool setting fixtures.

Another Automation First by Cross

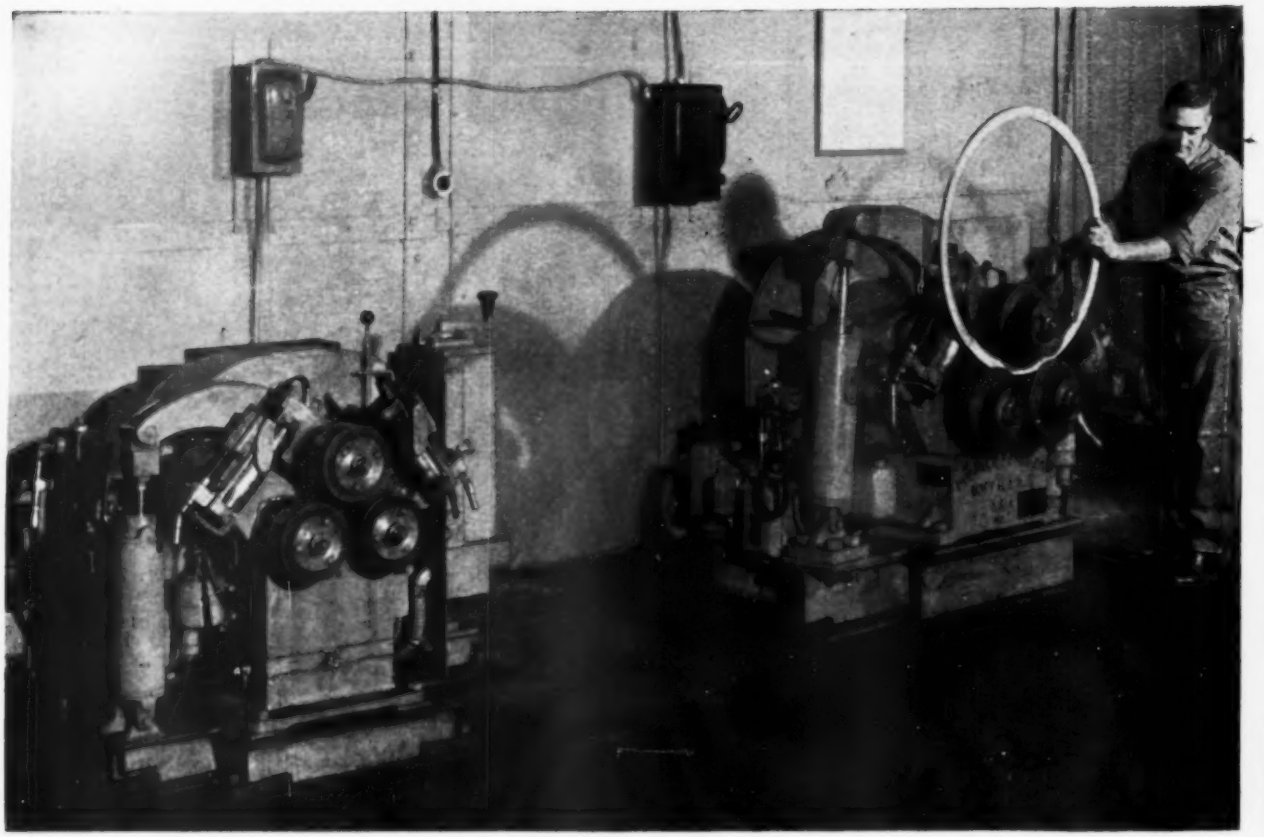


Established 1898

THE CROSS CO.

First in Automation

PARK GROVE STATION • DETROIT 5, MICHIGAN



Three "Buffalo" Vertical Bending Rolls, Nos. 0, 1 & 2.

LET "BUFFALO" TAKE THE KINKS OUT OF YOUR

Wide Range of Sizes for Almost Every Application . . .

Do you bend structurals into circles, segments or spirals? You could be boosting production and cutting costs right now—with a "Buffalo" Bending Roll. These versatile machines save real time and money bending angles, rounds, squares, tubes, beams, channels, flats and special shapes.

There's a size and model to fit your needs—exactly. Choose from horizontal or vertical types. Capacities range from ½" x ½" x ⅛" angles bent to a 4" circle, to 8" x 8" x 1" angles in diameters from 84" up.

No dies are needed. Rolls are quickly changed and easily adjusted to handle practically any structural shape and diameter. Special rolls and attachments are available for specialized operations including leg-in bending.

Unique "Buffalo" design offers many advantages. When furnished wth hydraulic adjustment on upper roll, finished circles can be removed instantly, cutting production time by 30%. Wasteful straight ends on circles are kept to a minimum.

Decide now to improve your production bending. Ask your nearby "Buffalo" machine tool dealer for complete facts on "Buffalo" Bending Rolls. Or write for Bulletin 352-D.

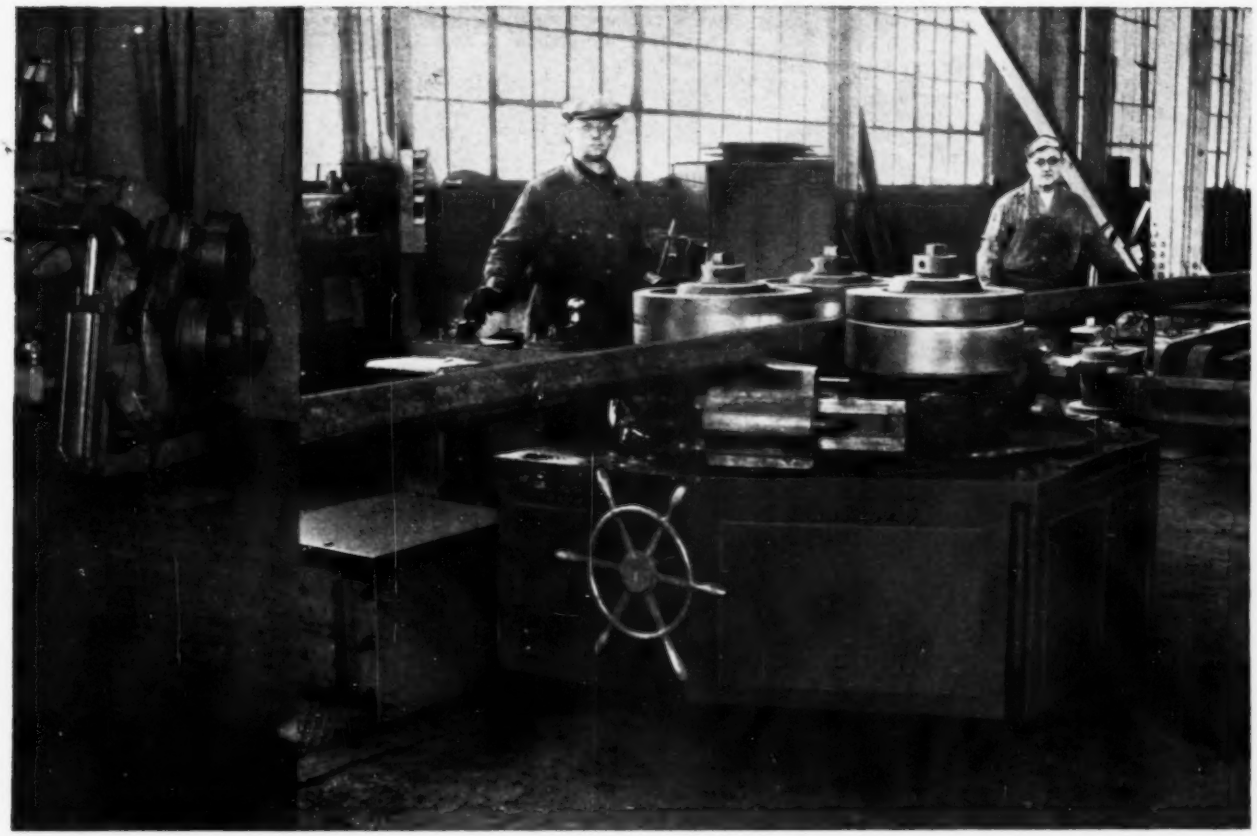
"Buffalo"

BUFFALO FORGE COMPANY 509 Broadway • Buffalo, N. Y.

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

◀ CIRCLE 178 READER SERVICE CARD

CIRCLE 179 READER SERVICE CARD

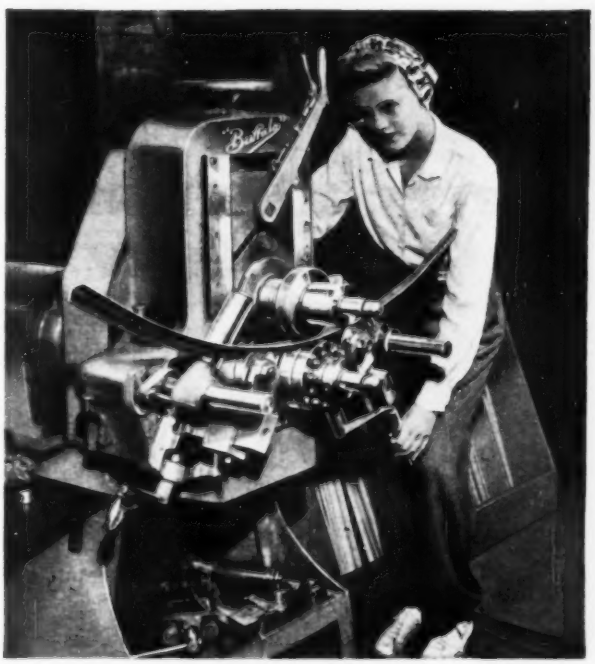


"Buffalo" No. 3 Horizontal Bending Roll Handling Heavy Angles to be used in fabrication of Spherical Water Tank.

PRODUCTION BENDING!

Specially Designed to Speed Diversified Production!

The "Buffalo" No. "OA" Bending Roll at right provides faster production on structural shapes requiring bending. This machine has proved especially useful in the aircraft and related industries. Complete retooling is accomplished in a few minutes. Special rolls and attachments permit an almost infinite range of uses. For full details on "Buffalo" No. "OA" Bending Rolls, write for Bulletin 3344-B.



DRILLING PUNCHING SHEARING BENDING

PIPE MACHINERY THREAD GAGES

As a precious stone is carefully cut and polished by an expert jeweler—so every Pipe Machinery thread gage is painstakingly lapped by experienced craftsmen to remove soft grinding skin, fat end threads and to produce a low micro finish.

Modern inspection facilities assure rigid operator control during every step of this important lapping process . . . assure a finished product of uniformly high quality with built-in wear life second to none.

When you purchase a Pipe Machinery thread gage, you can be certain the best in material, the best in equipment and the best in human skill have gone into its manufacture.

Write today for further information on our complete line of gages.

THE PIPE MACHINERY COMPANY • 29100 Lakeland Boulevard • Wickliffe, Ohio • Greater Cleveland

CIRCLE 181 READER SERVICE CARD

CIRCLE 182 READER SERVICE CARD ►

Man-made diamonds add the newest "Touch of Gold" value to carbide grinding

In carbide grinding the product-improving, cost-cutting "Touch of Gold," created by Norton leadership in diamond wheel development, began back in 1930. Today, man-made diamonds are adding something new to the "Touch of Gold." Their use as abrasives is steadily increasing, because of their improved performance and economy.

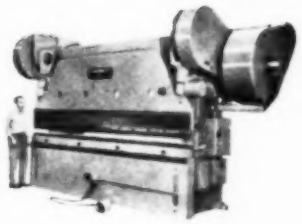
Norton was first to introduce all three bond types of diamond wheels . . . manufactures with complete uniformity of specification . . . produces the largest line . . . and *certifies* the diamond content of each wheel. Today, similar pioneering continues Norton leadership in the use of man-made diamonds . . . bringing you better performance, longer service life and lower grinding cost for every dollar you spend. NORTON COMPANY, Worcester 6, Massachusetts.

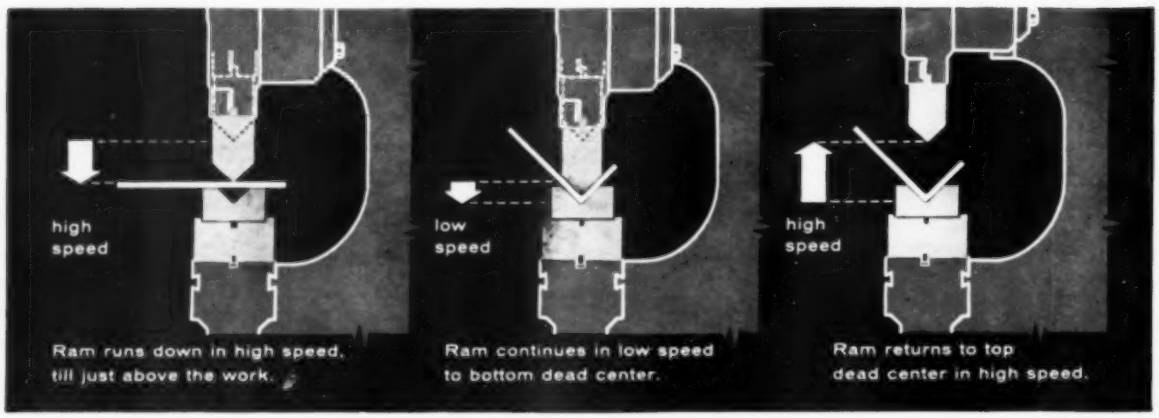
NORTON
ABRASIVES

Making better products . . . to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels • Grinding Machines • Refractories • Electrochemicals — **BEHR MANNING DIVISION:** Coated Abrasives • Sharpening Stones • Pressure Sensitive Tapes

INCREASE PRODUCTION AS MUCH AS 60% WITH CINCINNATI® Automatic Cycle Press Brakes




high speed
Ram runs down in high speed, till just above the work.
low speed
Ram continues in low speed to bottom dead center.
high speed
Ram returns to top dead center in high speed.

If you form long, flexible parts, you can increase your production up to 60% with a Cincinnati Automatic Cycle Press Brake.

A new, exclusive feature, the Cincinnati Automatic Cycle provides a combination of instantaneous fast and slow ram speeds with every stroke. As a result, you get maximum production speed without the "whip up" and "back bending" which often occur in high speed forming of long parts which have no beam strength.

You no longer have to rely on the operator's skill at clutch slipping to obtain parts that are free of "back bends."

You can get this money-making feature on all new 7 and 9 Series Cincinnati Press Brakes.

This productive new feature means a lot of advantages for you:

1. Job records show 10% to 60% increase in parts formed per hour.
2. Low speed portion of the ram stroke can be set so that all strokes are identical in length.
3. Rejects caused by "back bends" are stopped.
4. Highly experienced operators are not required.
5. Operator fatigue is greatly reduced because there is no need for clutch slipping.
6. Clutch and brake are long-life, minimum-maintenance units requiring no adjustments.

Write Dept. A for full details about the Cincinnati Automatic Cycle, Bulletin B-9R.

Shapers / Shears / Press Brakes

THE CINCINNATI SHAPER CO.

Cincinnati 11, Ohio, U.S.A.

Six ways ELCIDE 75* saves your plant time, work and money

LESS CUTTING OIL TO BUY. Elcide 75 stays effective *longer* than other bacterial inhibitors, increases the life of cutting oil emulsions up to 5½ times. You save on buying and handling.

FEWER DISPOSAL PROBLEMS. Disposal of spoiled emulsions is usually a costly, troublesome problem. By lengthening the life of cutting fluids, Elcide 75 saves you frequent hauling.

FEWER CLEANINGS OF MACHINES. Bacteria in coolants produce sludge that clogs machines. By controlling bacteria *effectively*, not halfway, Elcide 75 prevents sludge, cuts downtime.

CONTROLS A WIDER RANGE OF BACTERIA. Elcide 75 is a *combination* of proved bacterial inhibitors. No other inhibitors on the market, *singly or in combination*, can equal its control.

FEWER HEALTH HAZARDS. By controlling a wider range of bacteria than other products on the market, Elcide 75 lessens danger of harmful, costly health problems in your plant.

LESS CORROSION OF TOOLS, PRODUCTS. Elcide 75 keeps coolants fresh, stops buildup of acid by-products that corrode machinery and products, means fewer plant repairs.

NO OTHERS COMPARE!

The reason: Elcide 75's *exclusive* combination of active ingredients—Sodium Ethylmercuri Thiosalicylate (Thimerosal) and Sodium *o*-phenylphenate.

**Lilly's brand of bacterial inhibitor for cutting fluids*

For more information or to place your order, phone or write:

ELI LILLY AND COMPANY • AGRICULTURAL AND INDUSTRIAL PRODUCTS DIVISION • INDIANAPOLIS 6, INDIANA • PHONE MELROSE 6-2211

CIRCLE 184 READER SERVICE CARD

Buckets made from Republic Cold Drawn Stainless Steel Special Sections are shown being assembled on the rotor of a steam turbine produced by Elliott Company, a Division of Carrier Corporation.

REPUBLIC STAINLESS STEEL SPECIAL SECTIONS

Cut Costs, Simplify Machining, Resist Corrosion

Steel parts producers save thousands of dollars annually through the use of Republic Special Bar Sections for parts too difficult or impractical to produce by any other method.

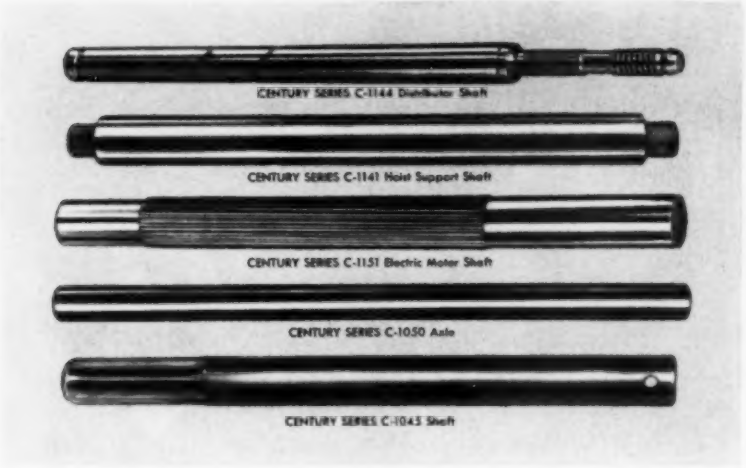
An excellent example is the use of Republic Cold Drawn Stainless Steel Special Sections for rotor buckets on a Type YR Mechanical Drive Turbine, produced by Elliott Company, Jeannette, Pennsylvania. The steam turbines are used to drive pumps, fans, compressors, or generators.

Buckets are made from Type 403 Stainless Steel for high resistance to abrasive wear, wet erosion, and the corrosive action of steam. They are produced at less cost because much of the machining has been eliminated through preforming to the predominating cross section of the part.

To these advantages, add the benefits Elliott derives from the increased physicals produced by the cold drawing process: greater strength for highly stressed parts; greater hardness; close accuracy to size; a bright, clean, smooth finish that eliminates the need for finishing operations on those surfaces retained in the part.

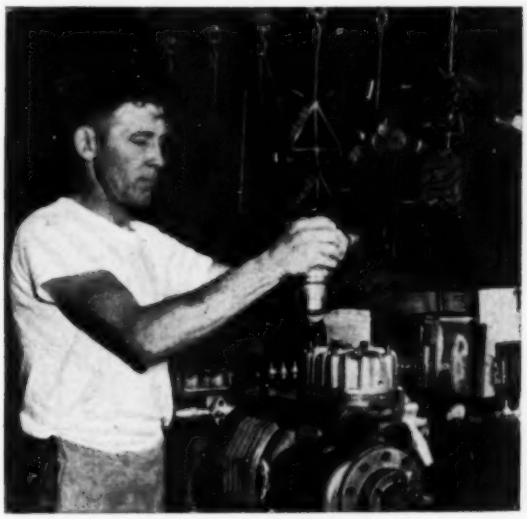
Republic Special Bar Sections offer almost limitless flexibility in design. One-piece shapes replace costly assemblies. Built-up, interlocking, or associated parts can be greatly simplified.

Produced in a wide range of sizes and contours, Republic Cold Drawn Special Sections are available in carbon, alloy, stainless steel, and titanium. Mail the coupon for full facts on cutting costs with Republic Special Bar Sections.


CENTURY SERIES C-1144 Distributor Shaft
CENTURY SERIES C-1141 Hoist Support Shaft
CENTURY SERIES C-1151 Electric Motor Shaft
CENTURY SERIES C-1050 Axle
CENTURY SERIES C-1045 Shaft

REPUBLIC'S CENTURY SERIES of high strength, stress relieved, cold finished steel bars meets the needs of steel parts producers requiring high strength with varying degrees of machinability. Available in five grades—C-1144, C-1141, C-1151, C-1050, C-1045—with each grade having a minimum yield strength of 100,000 psi. The CENTURY SERIES assures dimensional stability with excellent machinability, provides high mechanical properties in a range of chemistries, permits savings through selection of the grade best suited to your specific requirement. Mail the coupon for booklet on how the CENTURY SERIES can save you time and money.

REPUBLIC HEX HEAD CAP SCREWS solve difficult assembly problems. Available in a wide variety of steel analyses including stainless, alloy, high carbon (heat treated), and low carbon in sizes suited to all types of precision assemblies. Diameters range from ¼ inch to 2 inches inclusive, lengths to 12 inches. Fine or coarse threads. Other head styles on request. Contact your Republic Bolt and Nut Representative, or mail the coupon for more information.



REPUBLIC COLD FINISHED ALLOY BARS meet all requirements for critical king pins in White Motor Trucks. White machines the pins from 1⅞" round Republic 8620 Alloy. Essential to designing smaller sections to carry heavier loads safely is the outstanding combination of qualities provided by alloy steels. Then add the advantages of the cold finishing process and you have a material that offers machinability, strength, hardness, size, and close-sectional accuracy, smooth bright surface, and close tolerance straightness. Send coupon for full facts.

REPUBLIC STEEL

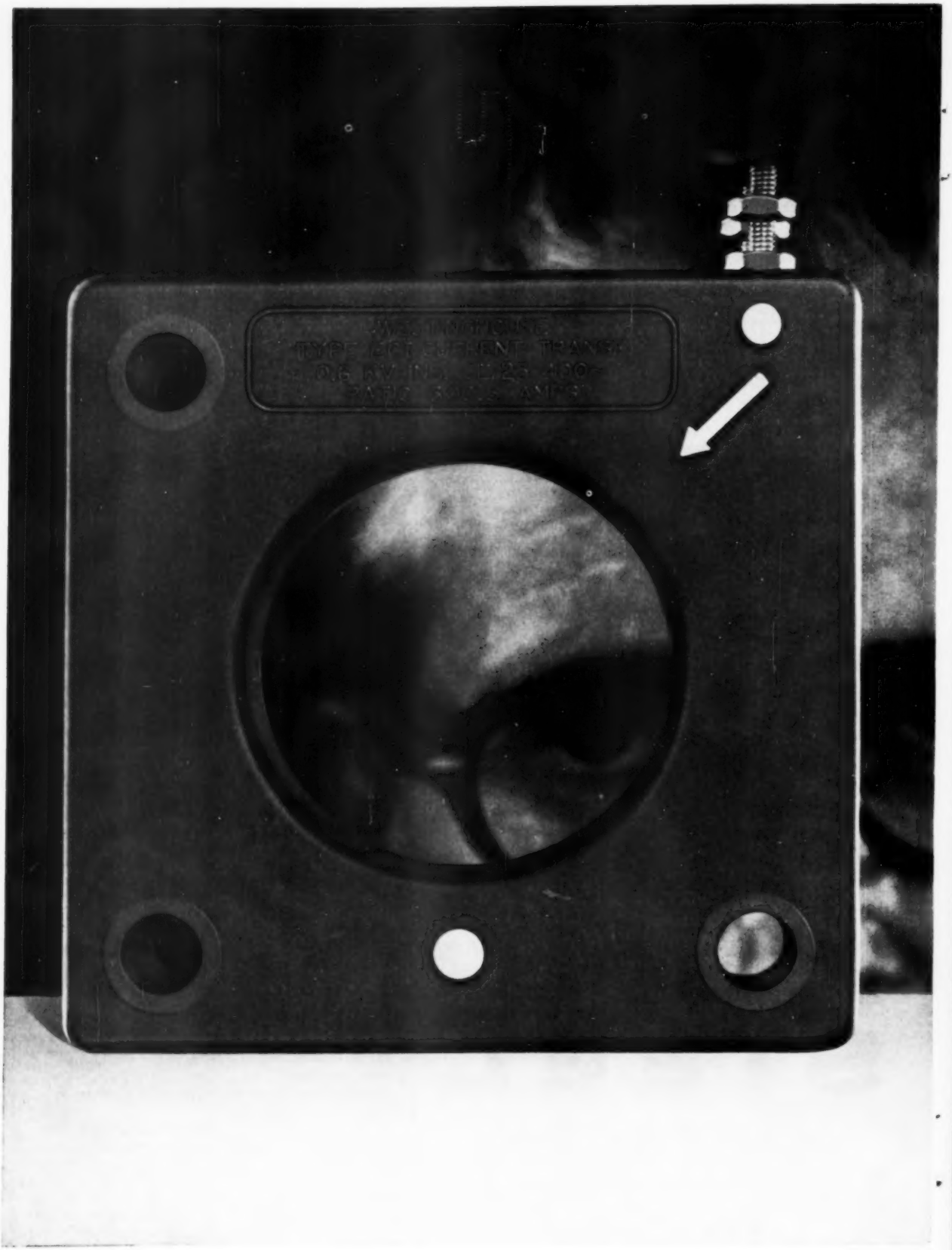
World's Widest Range of Standard Steels and Steel Products

REPUBLIC STEEL CORPORATION
DEPT. AM-8264
1441 REPUBLIC BUILDING • CLEVELAND 1, OHIO

Send more information on:

☐ CENTURY SERIES ☐ Cold Drawn Special Sections
☐ Hex Head Cap Screws ☐ Cold Finished Alloy Steel

Name _____ Title _____
Company _____
Address _____
City _____ Zone _____ State _____



New...Westinghouse Type ECI Current Transformer for indicating service in switchgear, switchboard and control equipment

Every major design consideration that can contribute to a longer useful life for instrument transformers is represented in the new ECI. Superseding Type OC-133, the ECI's outstanding performance starts with improved electrical strength. Rating factor has been increased from 1.0 to 1.33 for more overload capacity. Insulation level—up from 100 to 600 volts.

Polyester Rubber will not chip or crack, is unaffected by temperature extremes or cycling. Won't melt or contribute to electrical fires. Greater resistance to mechanical shock and shop damage.

The new mounting arrangement gives greater flexibility. Units may be flush-mounted on panels by three holes through the body of the transformer, or mounted upright by the use of steel feet.

More design facts: 10 kv BIL, primary amperes 100-800, 25 through 400 cycles. Ideally suited for multiple ratio applications.

If you've been missing performance like this in instrument transformers, get in touch with your Westinghouse representative, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

J-70930

YOU CAN BE SURE...IF IT'S Westinghouse

WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV FRIDAYS

NEW . . . LMC transformer's larger window opening takes any size cable or bus normally used from 1200 through 4000 amps. Metering and relaying accuracy equal or superior to any other transformer. Available in single or double ratings from 1200 through 4000 amps.

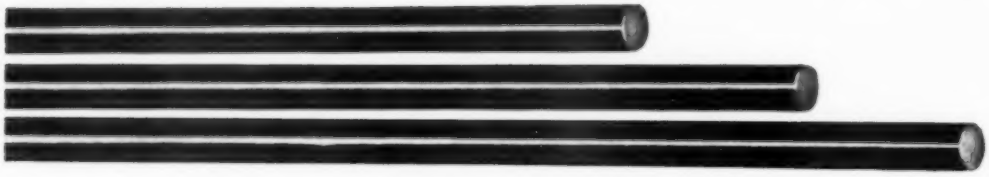
NEW . . . ECT-2.5 current transformer, 10 through 1200 amps; 50% more overload capability than any other unit; mechanical rating—125 times normal; thermal rating—100.

NEW . . . 600- and 1200-volt type LMPL potential transformers; smaller and lighter than any other equipment in this class; maintain 0.3 metering accuracy; indoor or outdoor applications.

ALL these new transformers are molded of Polyester Rubber—a product of Westinghouse research.

*Important Cost-Reducing News from 30 Years of Research and Production of High-Strength, Furnace-Treated Steels!**

NOW IN ALLOY AS WELL AS IN CARBON



BLISS & LAUGHLIN MONEY-SAVING Strain-Tempered®

COLD FINISHED STEEL BARS

* Eliminate Heat-Treating Costs

* Save In Grade and Processing Extras

* Pay Only For the Grade Needed

Bliss & Laughlin again brings you another benefit of its long-range product development program—ALLOY Strain-Tempered bars to supplement an extensive line of CARBON Strain-Tempered bars. The cost-saving advantages are significant!

IF YOU USE HEAT-TREATED ALLOY BARS, you can save up to 30% in processing extras by switching to Bliss & Laughlin Strain-Tempered Alloy bars. Strength and hardness are equal. Machinability is comparable. Ductility is somewhat lower, but adequate for many applications. Size limitations depend on individual specifications. With Strain-Tempered Alloy bars, it is frequently possible to select a grade with a lower grade extra than is possible with heat-treated alloys, thus saving additional money.

IF YOU HEAT TREAT ALLOY STEEL PARTS, Strain-Tempered Alloy bars may meet your hardness specifications at lower cost. In addition, problems of distortion and finish associated with heat treatment are eliminated. Strain-Tempered Alloys can be tailored to hardness in the 30 Rockwell "C" range and up to 40 Rockwell "C" and higher in some combinations of size and alloy grade. Ductility and impact properties, while lower than in heat-treated alloys, do not impair performance in many applications.

IF YOU HEAT TREAT CARBON STEEL PARTS, Bliss & Laughlin Strain-Tempered Carbon steel bars will provide equivalent strength and hardness, with adequate ductility and toughness. You save heat-treating costs, reduce fabricating time and eliminate costly operations formerly required to correct distortion of parts in heat treatment.

IF YOU NOW BUY C-1144 STRAIN-TEMPERED OR COMPARABLE TRADE NAME STEELS, a review of your machining operations may indicate costs can be reduced by switching to a lower-cost, less-machinable grade. Note the comparative data in the chart at the right. By selecting the grade providing only the machinability needed, you do not pay a premium price for machinability you do not use. Savings can range up to $24.00 per ton.

RESEARCHED AND PRODUCED FOR 30 YEARS. Heavy draft, furnace-treated steel bars were pioneered by Bliss & Laughlin 30 years ago. They are backed by nearly 70 years of experience in producing all grades of cold finished steel bars that can be used profitably by customers. In 1929, the first Strain-Tempered bar was produced for automobile drive shafts. By 1931, Bliss & Laughlin supplied 75% of one automotive company's requirements. Today Bliss & Laughlin is furnishing large quantities of standard alloy grade Strain-Tempered bars for drive shafts, as well as for many other purposes requiring high strength. A notorized certified report on the chemical and physical properties accompanies every Strain-Tempered mill shipment, evidence of the exacting quality standards which you can expect from Bliss & Laughlin.

You will be money ahead asking a Bliss & Laughlin representative to analyze your present use of high-strength alloy and carbon steels. He will recommend without obligation, the most suitable, least costly alloy or carbon grade from Bliss & Laughlin's extensive line of Strain-Tempered bars.

Specialists in Finish, Accuracy, Straightness, Strength and Machinability

BLISS & LAUGHLIN

Largest Independent Producer of Cold Finished Steel Bars

GENERAL OFFICES: Harvey, Ill. • PLANTS: Harvey, Detroit, Buffalo, Mansfield, Mass.

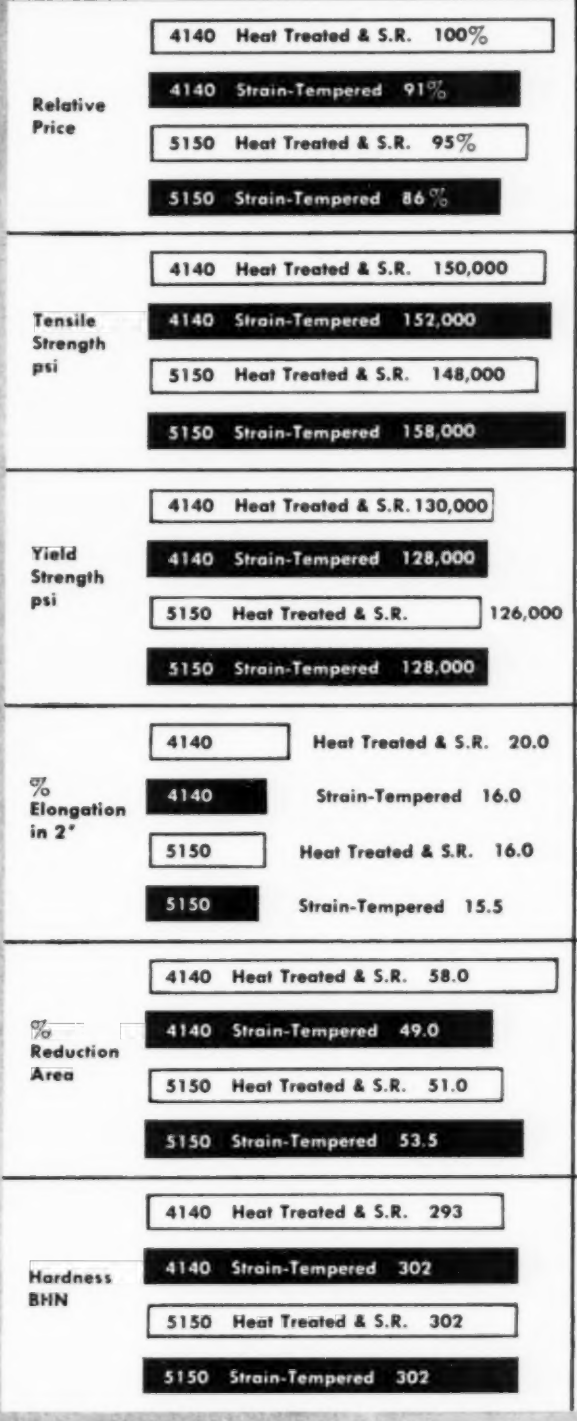
CIRCLE 189 READER SERIVCE CARD

CIRCLE 190 READER SERVICE CARD ►

COMPARISON OF 7 TYPICAL GRADES OF BLISS & LAUGHLIN Strain-Tempered BARS

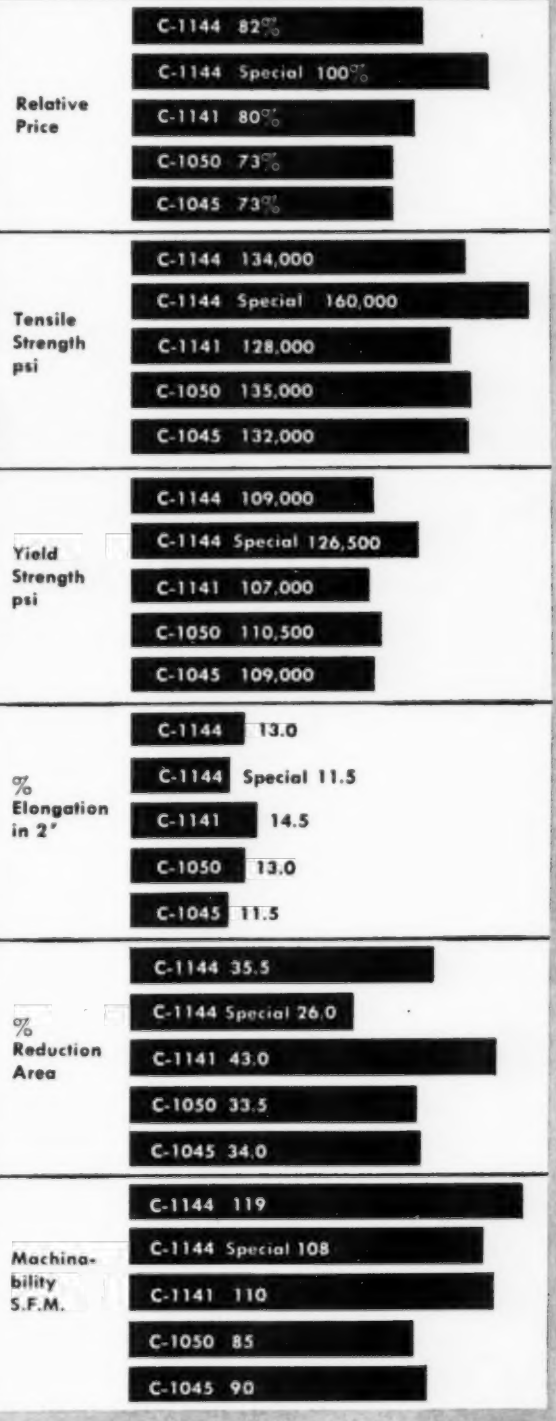
ALLOY

Comparison of 2 Strain-Tempered vs. Heat-Treated Alloys


Relative Price
4140 Heat Treated & S.R. 100%
4140 Strain-Tempered 91%
5150 Heat Treated & S.R. 95%
5150 Strain-Tempered 86%
Tensile Strength psi
4140 Heat Treated & S.R. 150,000
4140 Strain-Tempered 152,000
5150 Heat Treated & S.R. 148,000
5150 Strain-Tempered 158,000
Yield Strength psi
4140 Heat Treated & S.R. 130,000
4140 Strain-Tempered 128,000
5150 Heat Treated & S.R. 126,000
5150 Strain-Tempered 128,000
% Elongation in 2"
4140 Heat Treated & S.R. 20.0
4140 Strain-Tempered 16.0
5150 Heat Treated & S.R. 16.0
5150 Strain-Tempered 15.5
% Reduction Area
4140 Heat Treated & S.R. 58.0
4140 Strain-Tempered 49.0
5150 Heat Treated & S.R. 51.0
5150 Strain-Tempered 53.5
Hardness BHN
4140 Heat Treated & S.R. 293
4140 Strain-Tempered 302
5150 Heat Treated & S.R. 302
5150 Strain-Tempered 302

CARBON

Comparison of 5 Popular Strain-Tempered Grades



REPRESENTATIVE TEST RESULTS AND PRICE COMPARISONS • BOTH CARBON AND ALLOY GRADES CAN BE LEADED

Another Example of Bliss & Laughlin Leadership!

MANHATTAN MOLDISCS

CUT FASTER... LAST LONGER

Manhattan Moldiscs are made in types to meet specific job requirements for use with mild steels, stainless alloys, aluminum or copper. Tests prove they're the most economical portable wheels you can use on right angle grinders . . . smoothing weldments, removing burrs, beveling edges. Manhattan Moldiscs cut cleanly and freely on the toughest roughing and finishing—without loading or glazing. They're safer to use, too, because they're light in weight, easy to handle . . . and reinforced with special super-strength synthetic fabric for greater safety. Manhattan Moldiscs do a better grinding job, and they last longer!

Ask a Manhattan abrasive wheel engineer to demonstrate the advantages of Manhattan Moldiscs . . . available in a wide range of types from harder, stiff bonds for roughing—to resilient, flexible bonds for fine finishing.

To get "More Use per Dollar" also on other grinding or cutting jobs . . . specify Manhattan custom made, high speed, heavy duty abrasive wheels.

- FREE CUTTING
- REINFORCED FOR GREATER SAFETY
- WILL NOT LOAD OR GLAZE
- LIGHTWEIGHT, EASY TO CONTROL
- SPECIAL BONDS FOR ROUGHING AND FINISHING

"More Use Per Dollar"

RMD40

WRITE TO THE ABRASIVE WHEEL DEPARTMENT

MANHATTAN RUBBER DIVISION—PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

Belts • Hose • Roll Covering • Tank Linings • Industrial Rubber Specialties • Abrasive and Diamond Wheels • Brake Blocks and Linings • Clutch Facings • Asbestos Textiles • Mechanical Packings • Engineered Plastics • Sintered Metal Products • Industrial Adhesives • Laundry Pads and Covers • Bowling Balls

PRODUCTION POINTERS from GISHOLT

More cost-cutting IDEAS– to help you

HOW BARBER-COLMAN ELIMINATES "GUESSWORK" ON MACHINE REPLACEMENT

Two-point program determines need, turns future losses into profits

With careful planning, as shown here, it is easy to discover profit leaks in old equipment before they become serious losses. Substantial savings and earnings result when replacement is timed right.

The 2-point program used by Barber-Colman Company, Rockford, Illinois, is a modification of the MAPI Formula. It pinpoints the most opportune time for action and verifies the purchase decision on actual work.

Here's how this plan works: Barber-Colman made a detailed study comparing a new Gisholt No. 5 Ram Type Turret Lathe and an old turret lathe on the basis of the coming year's work. Production rates and operating, maintenance and depreciation costs for each machine were analyzed on the Barber-Colman Standard Replacement Analysis Form.

These costs (including renovating) for the old machine indicated that immediate replacement with a new No. 5 would effect substantial savings in costs during the first year alone. The new Gisholt offered greater swing for a wider work range. Greater horsepower, higher speeds and a wider feed range would permit more efficient use of carbide, ceramic and cemented oxide tools.

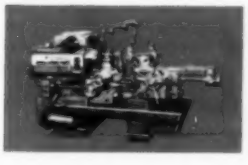
Four months after purchase, a careful on-the-job analysis showed that the new Gisholt saved an average of 38% in production time on all parts.

Here's how this versatile Gisholt No. 5 allowed a 58% saving on a typical problem part—a 3-pound, 9" aluminum brake arm for a Barber-Colman textile machine. A face-plate fixture is used for locating, holding and driving. Drilling, forming multiple-face diameters, boring and reaming are handled from the hex turret. A single tool on the cross-slide square turret faces the boss at the end. Total f.t.f. time is 5.7 minutes as compared with 14.1 minutes on the old machine.

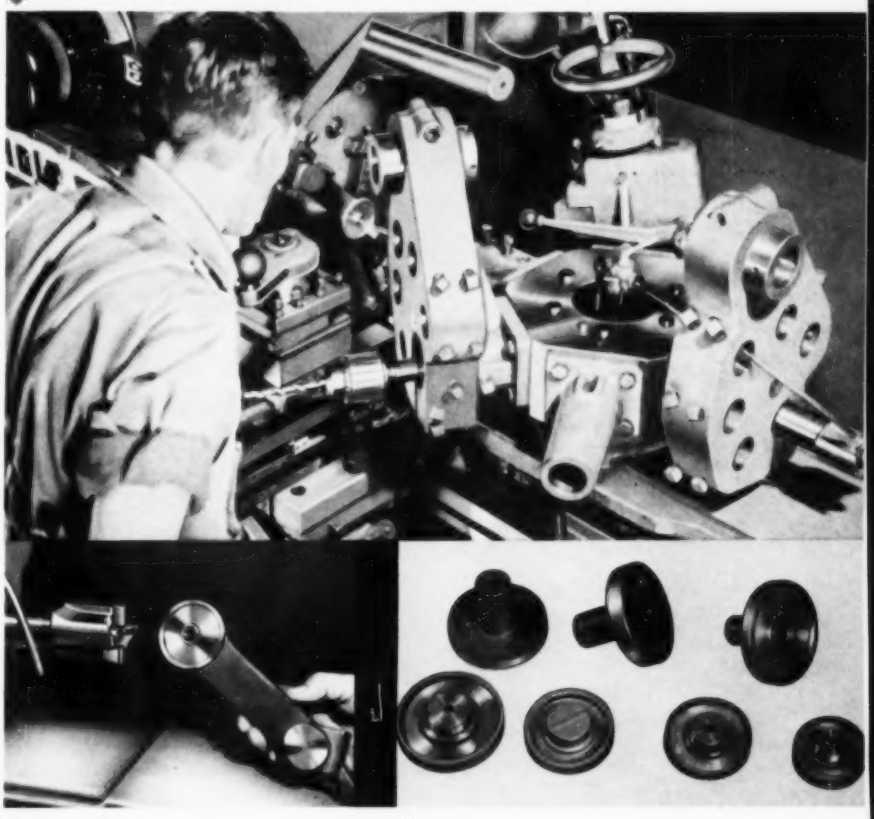
A few of the many parts handled in like manner with similar savings are shown at bottom. Change-over is fast and easy. The standard multiple and flanged toolholders remain in position on the hex turret. Only the standard boring bars, toolholders, stops, etc., are replaced or reset. The fine surface finishes obtained despite multiple-form cutting in a single pass speak for the rigidity and power of the Gisholt No. 5.

Sound program pinpoints timely replacement. Time saved averages 38%.

For complete facts on No. 5 Ram write in No. 1749 on inquiry card.



A typical example of the simple tooling allowed by the Gisholt MASTERLINE No. 5 Ram Type Turret Lathe. Many different parts are machined with the same basic setup. Production time on all parts averages 38% faster than obtained with the old machine.



The new Gisholt No. 5 machines this 3-pound cast aluminum brake arm 58% faster than the old machine. Multiple-diameter cutter completes face diameters in one pass for greater accuracy.

Typical workpieces. Top row: Rack and pinion gear blanks. Bottom: Brass disc holder valve assemblies. Fine surface finish on multiple-diameter faces obtained in a single pass demonstrates machine rigidity.

DIESEL ENGINE MANUFACTURER CUTS HANDLING 50%, MACHINING 30% ON FLYWHEELS

No. 24 with loader and back-boring attachment speeds work and improves accuracy

In high-production machining, even a few seconds saved per piece spell the difference between profit and loss. This setup gives you ideas on reducing handling and machining time, using single-spindle automatics.

The machine is a Gisholt MASTER-LINE No. 24 Automatic Chucking Lathe. Over 75 different sizes of cast iron flywheels are handled in lots of five to 100 pieces. Diameters range from 13" to 24", widths from 2" to 6".

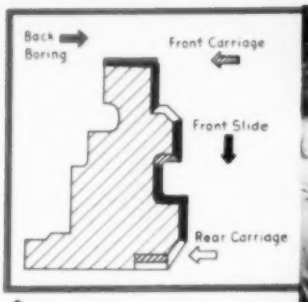
Proper machine selection and smart tooling solve three problems:

Work Handling—cut 50% by a headstock-mounted swinging loader.

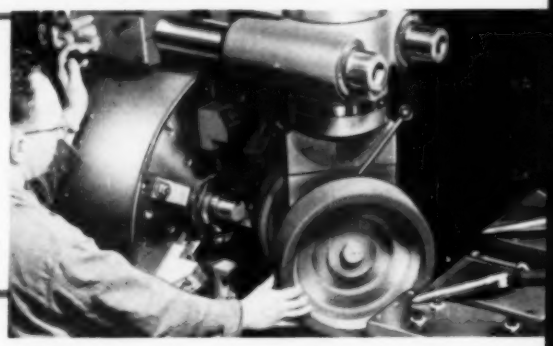
Accuracy—improved by a spindle-mounted back-boring attachment that combines boring with other cuts in a single chucking.

Floor Space—formerly, two machines were required. Now one No. 24 handles the entire range; provides the swing, rigidity and power to remove metal faster in 30% less time.

Here's how the part shown—14" diameter, 3.880" wide—is handled.



Surfaces machined in just 4.6 minutes, f.t.f. Arrows show carriage and slide movements.



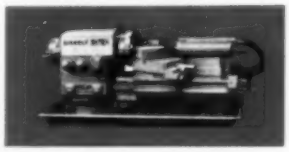
Operator indexing work carrier. Note back-boring attachment in spindle bore.

While one part is being machined, another is positioned on a headstock-mounted swinging loader which has a 2-position indexing stock carrier. At cycle end, simple loader controls permit the following sequence: swing carrier parallel to machine center line; traverse in to pick up finished part; traverse out and hold while carrier is indexed 180°; traverse in and hold while new part is located and gripped in power-operated chuck; traverse out and swing carrier clear of tools. During automatic cycle the operator checks and removes the finished part and loads next workpiece.

The drawing shows the various surfaces machined. Total f.t.f. time, just 4.6 minutes—including only .8 minute to load, operate and unload.

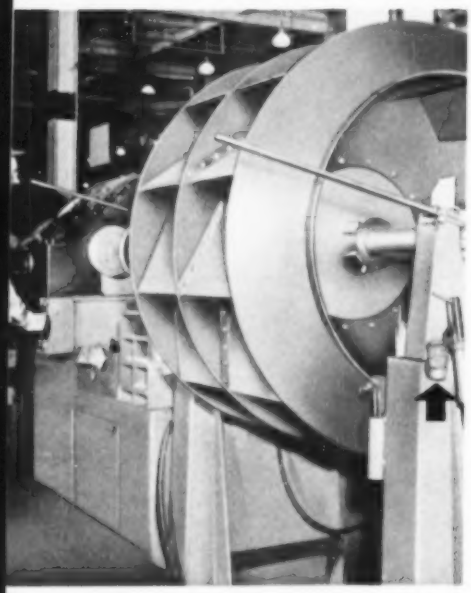
Loader cuts work-handling time .8 minute per piece. Back-boring attachment permits use of fast, rugged No. 24; cuts machining time 30%; provides greater accuracy, longer tool life, finer finish.

For complete facts on No. 24 Auto Chucking Lathe write in No. 2749 on inquiry card.



HOW TRANE CO. SAVES ON LARGE-PART JOB-LOT BALANCING

Balancing machine flexibility and fast setup trim costs



Operator, completing setup, prepares to start balancer. Arrow indicates convenient welding equipment.

Do you think of balancing in terms of long production runs? Do you consider job-lot balancing too costly to handle in your own shop? This setup shows that even single units can be balanced with greater accuracy for less than it costs to transport the work to and from a balancing subcontractor.

Accurate balancing is highly important in the operation of centrifugal fan wheels used in air-conditioning, ventilating and industrial process systems. Operating noise must be kept to a minimum and vibration must be eliminated.

The Trane Company, La Crosse, Wisconsin, not only meets those requirements but trims costs on job lots by using a Gisholt Type 6UH Balancer. Machine versatility permits handling wheels from 24" to 89" in diameter, $9^{15}/_{16}$" to $97^{13}/_{16}$" in width, 80 to 4500 pounds. Lots range from one to 75 units.

Here are the steps for balancing a single part (the 54" double-width, double-inlet fan wheel shown above):

Workpiece—insert supporting arbor. Machine—insert half bearings and adjust to work width. Load work; attach drive coupling; position angle indicating rods; rotate; note angle and amount of unbalance in each plane; stop work; index and weld correction weights at indicated angles; rotate for inspection reading; make any final correction required; remove. F.t.f. time, just one hour and 45 minutes.

Balancing identical parts is still faster. The machine is set up on the first piece and calibrated to indicate the exact amount of material to be added or removed, in terms of the correction method used. The remaining parts can then be handled in one quick reading.

Flexible Gisholt Balancer handles wide work range at lowest unit cost. Fast setup saves time—even on 1-piece jobs.

For complete facts on "U" Balancers write in No. 3749 on inquiry card.

ASK YOUR GISHOLT REPRESENTATIVE ABOUT FACTORY-REBUILT

LEYLAND MOTORS LTD. SAYS, "SUPERFINISHED PARTS LAST LONGER"

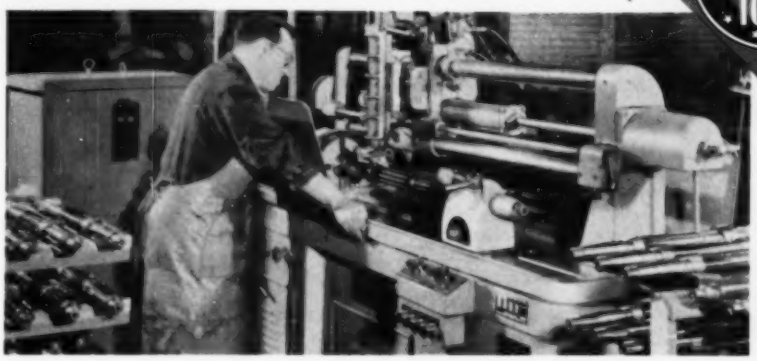
MASTERLINE GISHOLT SINCE 1887

Superfinishing improves quality, extends service life of heavy-duty transmission parts

Superfinish can cut your costs many ways—it eliminates or reduces grinding time and provides a finer finish for longer service life. It is flexible—can be used on cylindrical, flat, tapered, spherical or eccentric surfaces. Setup is fast and does not require highly trained personnel. Except for loading and unloading, the operator is free for other work.

The setup used by Leyland Motors Limited, Lancashire, England, may give you some ideas on how Superfinish can be used in your own operations. The machine, a Gisholt Model 51-A General-Purpose Superfinisher, handles a wide variety of transmission parts used in cars and trucks.

On the main-shaft setup (shown), 60 pieces are produced per lot. Superfinishing of a single 1½"-long bearing diameter removes .0002" stock.



Gisholt Model 51-A General-Purpose Superfinisher at Leyland Motors Limited, used to improve quality and lengthen service life on a wide variety of heavy-duty transmission parts. Note how parts are "banked" on racks behind and at right of operator to speed work flow.

It reduces the previously ground surface to a "controlled" 3 micro-inch RMS finish. F.t.f. time, only 2.4 minutes. Stone life on the 60 Rockwell C material is about 700 pieces.

Superfinishing costs are less, compared to the time and grinding wheel expense that would be required to finish-grind to 3 micro-inches RMS.

Wide adaptability makes the Model 51-A ideal for job lots or production runs. Savings in cost, plus increased customer satisfaction due to increased service life, justify a thorough investigation of Superfinish on all your parts.

For complete facts on 51-A Superfinisher write in No. 4749 on inquiry card.

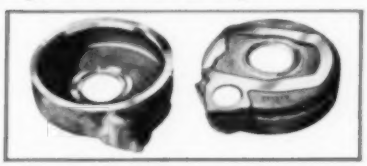
HERCULES MOTORS SAVES 43% WITH AUTOMATICS ON JOB LOTS

Fast chucking on versatile Simplimatic is key time-saver

If you produce a variety of parts in small lots, similar in design but varying in dimension, automatics will cut your costs.

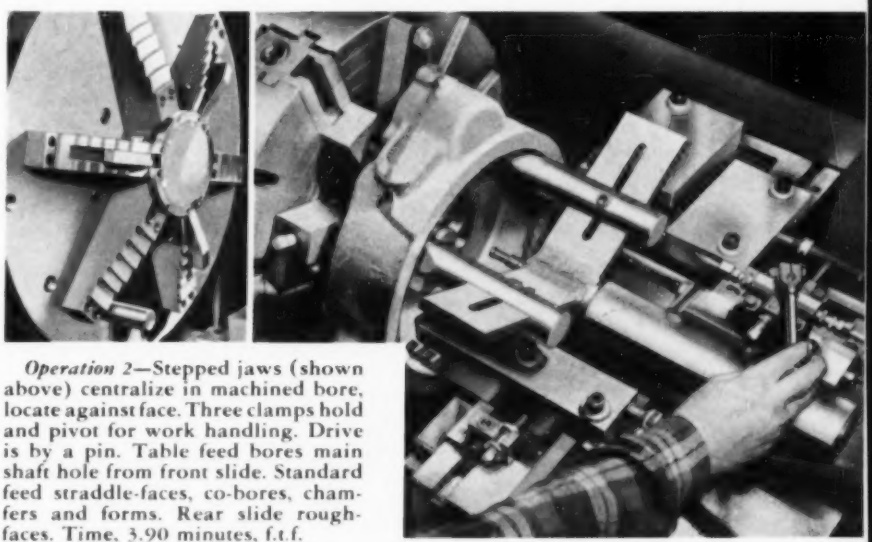
For example, check this setup at Hercules Motors, Canton, Ohio. The first three operations on 11 different sizes of cast iron industrial engine gear housings were being handled on 6 hand-operated lathes. Lots were small, 5 to 200 pieces. Bores ranged from 10" to 20". Annual production was sufficient to justify use of three automatics—if each could be equipped with a single fixture and a set of tooling developed to handle the entire work range.

These requirements were met by three gapped-bed Gisholt MASTERLINE Simplimatics, cutting machining time 43% on these parts.



Here's the sequence on the medium-sized, 14$^{13}/_{64}$"-bore housing shown.

Operation 1 (setup shown at right)—Three-point loader centralizes work on spring-loaded, tapered chuck jaws, against jacks. A drawbar clamps in small bore. Drive is by a pin in starter gear hole. Open end is faced, bored and chamfered. Time, 3.80 minutes, f.t.f.



Operation 2—Stepped jaws (shown above) centralize in machined bore, locate against face. Three clamps hold and pivot for work handling. Drive is by a pin. Table feed bores main shaft hole from front slide. Standard feed straddle-faces, co-bores, chamfers and forms. Rear slide rough-faces. Time, 3.90 minutes, f.t.f.

Operation 3 (same fixture as operation 2)—Front slide tools rough-turn small hub. Rear slide tools finish 8½" interrupted face. Center slide tools finish-turn and chamfer small hub, finish-bore and chamfer main shaft hole. Time, 7.70 minutes, f.t.f.

Fixture and tooling, adjustable for wide work range, permit mass-production efficiency on job lots. Three automatics replace 6 hand-operated lathes, cutting time 43%.

For complete facts on Simplimatic write in No. 5749 on inquiry card.

GISHOLT

MACHINES WITH NEW MACHINE GUARANTEE

MASTERLINE
GISHOLT SINCE 1887

HOW CANADIAN INGERSOLL-RAND CO., LTD., SAVES ON FIXTURING

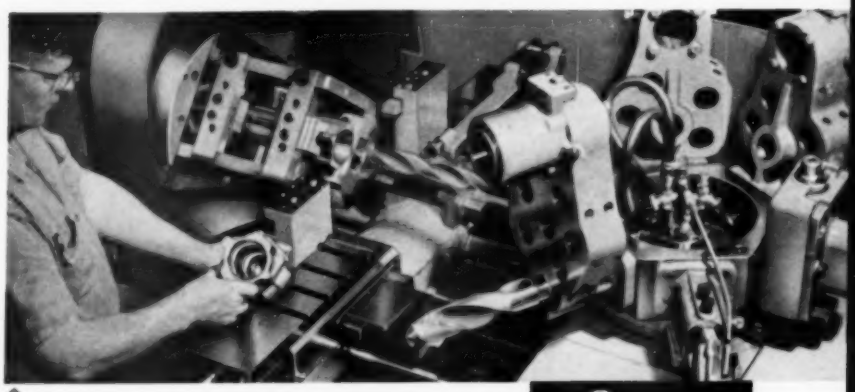
Fastermatic handles job lots automatically, cuts machining time 50%, change-over time 19%

With the right machine—the right fixturing and tooling—your short-run fixture jobs can be handled automatically at considerable savings.

That's the story at Canadian Ingersoll-Rand Co., Ltd., Sherbrooke, Quebec, Canada. Here over 40 different parts—in lots of 40 to 110—have gone automatic on two Gisholt MASTERLINE 2F Fastermatic Automatic Chucking Turret Lathes (replacing four old automatics). Average machining time has been cut 50%. Setup is 19% faster. Workpieces include long and unwieldy drifter, paving breaker and jackhamer cylinders, washers, handles, cylinder heads and gear blanks for rock drilling equipment.

Shown above is a typical setup for the Universal jackdrill cylinder, held by the operator. The fixture used here provides a 12% saving in chucking alone. Replaceable V-blocks and an adjustable base allow cross, length and height adjustment to accommodate three different cylinders.

Interrupted facing is handled by cross-slide tools. Two drills and three multiple-diameter cutters on the hex turret drill, face and chamfer the 3-diameter bore, completing the part.

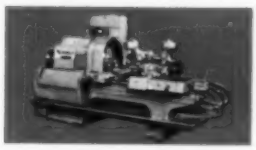


Operator holds Universal jackdrill cylinder 12¾" long, 4" maximum face diameter. Note internal machining and interrupted cut on face. Hex-turret-mounted, multi-diameter cutters simplify machining...assure maximum accuracy.

Two additional cylinders handled with same chucking fixture. Note interrupted cuts and deep hole drilling performed by Fastermatic, 50% faster than by former methods.

Versatile fixturing simplifies chucking of odd-size parts...allows automatic small-lot production. Smooth hydraulic feeds, and machine rigidity permit maximum metal removal. Automatic cycle permits operator to handle two machines.

For complete facts on 2F Fastermatic write in No. 6749 on inquiry card.



HOW FISHER GOVERNOR CO. BOOSTS PROFITS ON ODD JOBS

Turret lathes provide faster setup, more parts per shift

Held in face-plate clamping fixture, steel cooling fin head casting is drilled, bored, reamed and chamfered from the hex turret. Square turret tools face, turn and groove. This setup was made to machine four parts.

Any producer has a number of odd machining jobs that must be worked into the daily production schedule. Setups may be required for even a single rush-order piece. Floor-to-floor time on these small lots is important—but not so important as machine flexibility and fast change-over. This is where Gisholt MASTERLINE Turret Lathes pay big dividends.

Fisher Governor Company, Marshalltown, Iowa, uses a battery of 36 Gisholt Ram and Saddle Type Turret Lathes to handle standard production items and odd jobs at lowest cost.

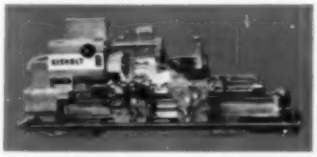
The setup shown, on a Gisholt 2L Saddle Type Turret Lathe, is specifically for small-lot work. Using the same basic clamping fixture, hex and square turret tooling, the 12 pieces shown were machined in just one 8-hour day. Eight different setups were required: one each for a 2-piece and a 4-piece lot; and one each for six pieces. F.t.f. times ranged from 8.2 to 18.8 minutes, depending on size and type of part.

Your costs can be cut, too, with the same turret lathe features that meet Fisher Governor Company's requirements for accuracy and production. Gisholt Turret Lathes are heavier... offer more horsepower...are built to remove more metal to closer tolerances in a given amount of time. Quick setup, ample capacity, low tooling costs and a wide range of easily selected speeds and feeds, plus production-proved accessories, will make light work of your toughest jobs.

Eleven other parts—requiring eight different setups, completed in one 8-hour shift on the versatile Gisholt 2L Saddle Type Turret Lathe.

For complete facts on 2L Saddle Type Turret Lathe write in No. 7749 on inquiry card.

Twelve parts requiring eight different setups completed in one 8-hour shift. Gisholt Turret Lathes assure flexibility, fast change-over and ease of operation for more profits on short runs.



No. 9-1059
749

The Gisholt Round Table represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

Printed in U.S.A.

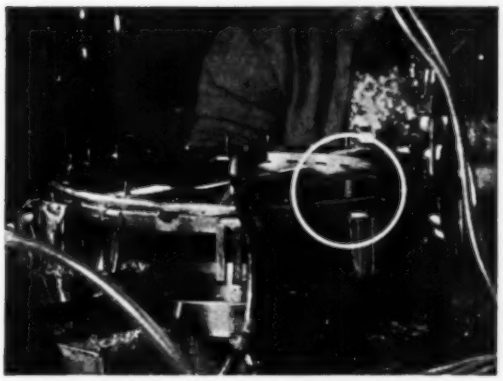
GISHOLT MACHINE COMPANY Madison 10, Wisconsin

Turret Lathes • Automatic Lathes • Balancers • Superfinishers • Threading Lathes • Packaging Machines • Masterglas Molded Plastic Products

Practical Tooling Tips

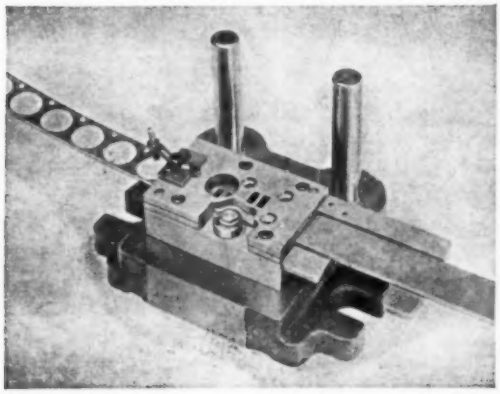
No. 3 of a series

Are your tool makers wasting time making complicated tooling gadgets when a standard, off-the-shelf Vlier part could do the job much better? Why not examine your present drawings and see where these simple, low-cost parts can be used. You will be amazed at the savings possible.

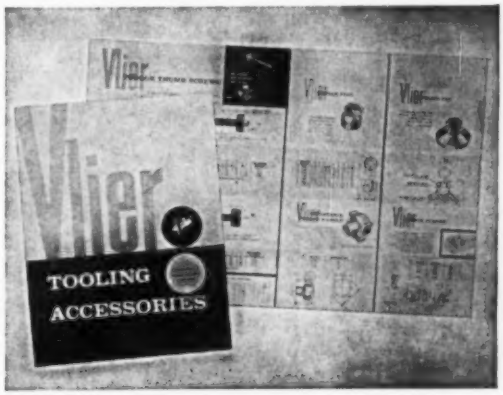


PRODUCTION INCREASED 300% when this 12-station automatic indexing and tapping fixture was put to work. Vlier Spring Plungers allow the operator to load by simply pushing the part into a slot. These simple, spring-loaded tools also position the part for the tapping operation. Available in four models; fifty sizes.

NEW SWIVEL PAD-TORQUE THUMB SCREW combines the Vlier Torque Thumb Screw and Swivel Pad Clamp. The result is a perfect holding tool—one that applies only the right amount of holding pressure without damaging the finished surface. Unique ball joint construction of the pad permits adjustment to off-angle surfaces.



PROPER STOCK ALIGNMENT IN PROGRESSIVE DIES becomes a simple task with the new Vlier Stock Pusher. Saves pilots. Mounts in tapped hole. Accommodates stock as thin as .010"; width variations totalling 1/16". Nothing to wear out or foul up.



NEW 1958 CATALOG NOW AVAILABLE—Eight pages; completely revised. Includes information and specifications on all new Vlier products, including the Torque Handle, Stock Pusher, Leveling Pad. Makes ordering easy. Suggests new uses for these proven time-savers. Write for your copy today!

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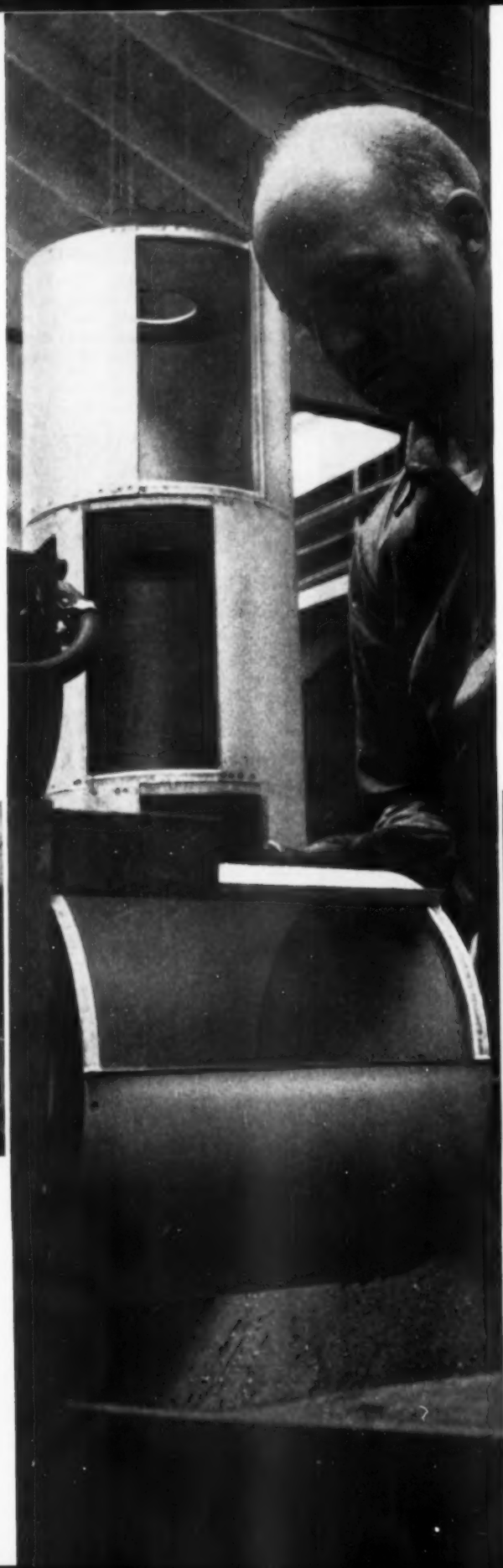
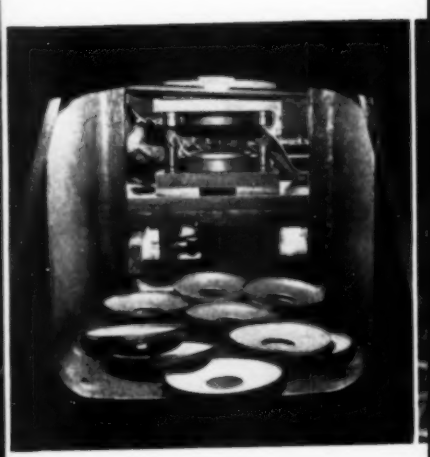
◄ CIRCLE 195 READER SERVICE CARD

CIRCLE 196 READER SERVICE CARD





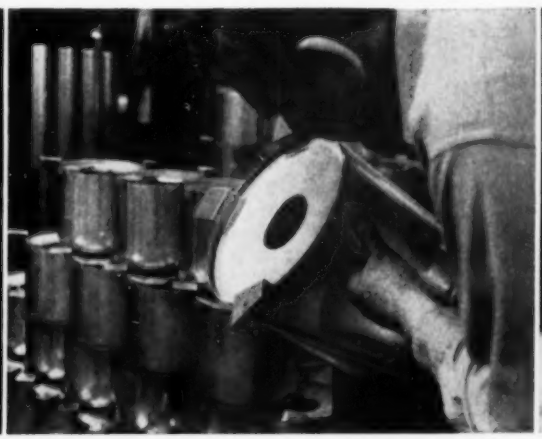
American Furnace hearths now made of USS Stainless Steel

The hearth of an oil furnace may glow at 1500°F. American Furnace Company used to make their hearths from fire brick, and these hearths were usually installed after the furnaces were delivered to the customers.

The company finally switched to Stainless Steel hearths because Stainless Steel *simplified* fabrication. It could be quickly cut, rolled, drawn and welded into a hearth that could be installed right at the factory. And the Stainless Steel doesn't absorb or insulate the heat. It transfers the heat faster, so it increases the combustion efficiency of the unit. It's safer . . . won't absorb oil, and it *cools* quickly, so there's less chance of accidental fire or explosion in the furnace.

When *you* need a material that's corrosion resistant, strong at high temperatures, and not difficult to fabricate, specify Stainless Steel. And for service-tested quality, specify USS Stainless Steel. Call the nearest office of United States Steel or your local Stainless Steel distributor.

USS is a registered trademark

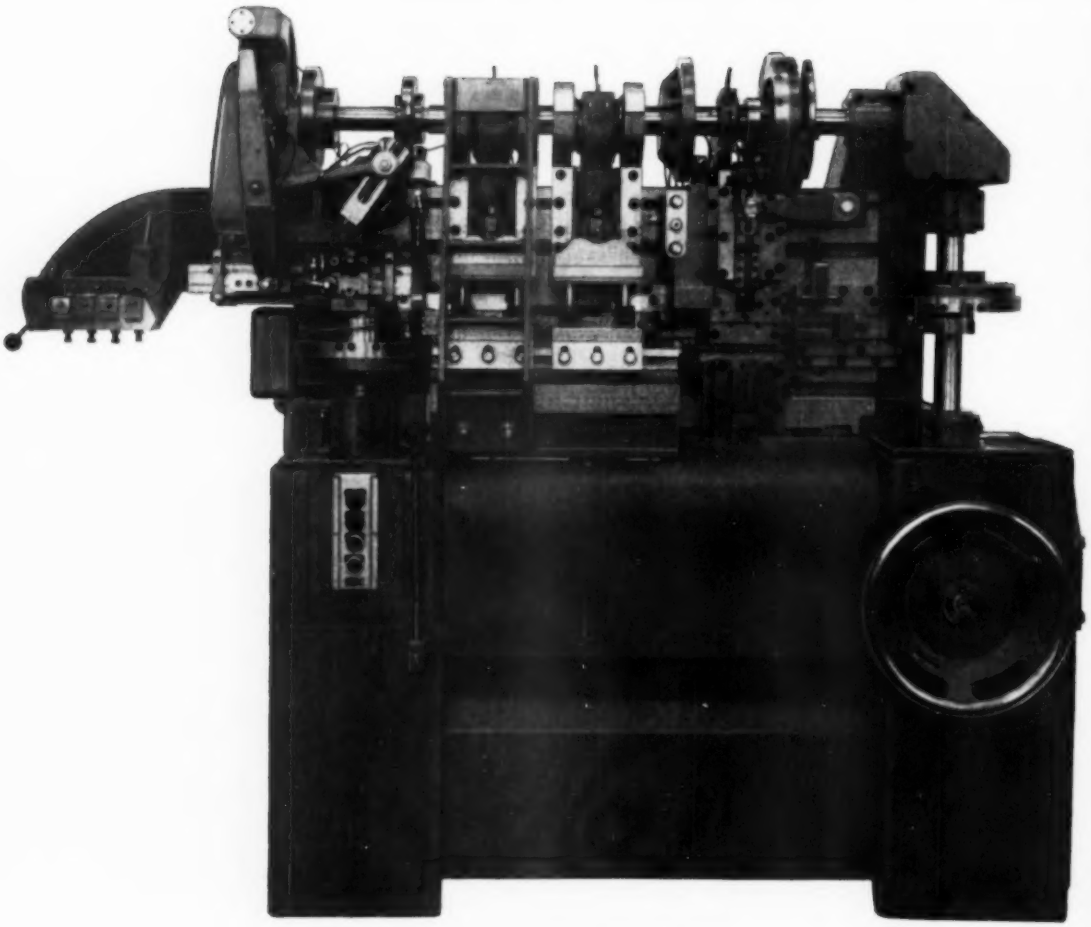


USS

United States Steel Corporation—Pittsburgh
American Steel & Wire—Cleveland
National Tube—Pittsburgh
Columbia-Geneva Steel—San Francisco
Tennessee Coal & Iron—Fairfield, Alabama
United States Steel Supply—Steel Service Centers
United States Steel Export Company

United States Steel

ON ITS FIRST PRODUCTION JOB THIS REVOLUTIONARY MACHINE...



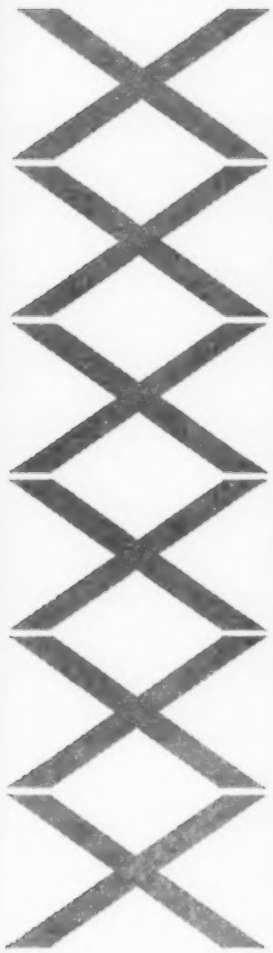
It's the sensational Torrington **Verti-Slide**, a most important **new** production tool. This amazing new vertical four-slide machine promises a genuine revolution in the **high-speed, high-precision, low-cost production** of just about everything in strip or wire that is now being produced on progressively tooled forming presses or conventional four-slide machines. Write or call today for complete technical data—or a Torrington sales engineer.

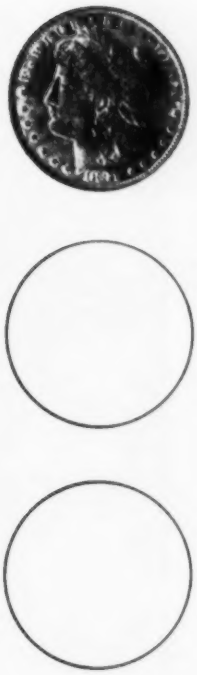
THE TORRINGTON MANUFACTURING COMPANY
TORRINGTON, CONNECTICUT • VAN NUYS, CALIFORNIA • OAKVILLE, ONTARIO

DID THE WORK
OF SIX
PROGRESSIVELY
TOOLED
FORMING PRESSES...

AT
FOUR TIMES
THE
SPEED...

AND
ONE-THIRD
THE COST!





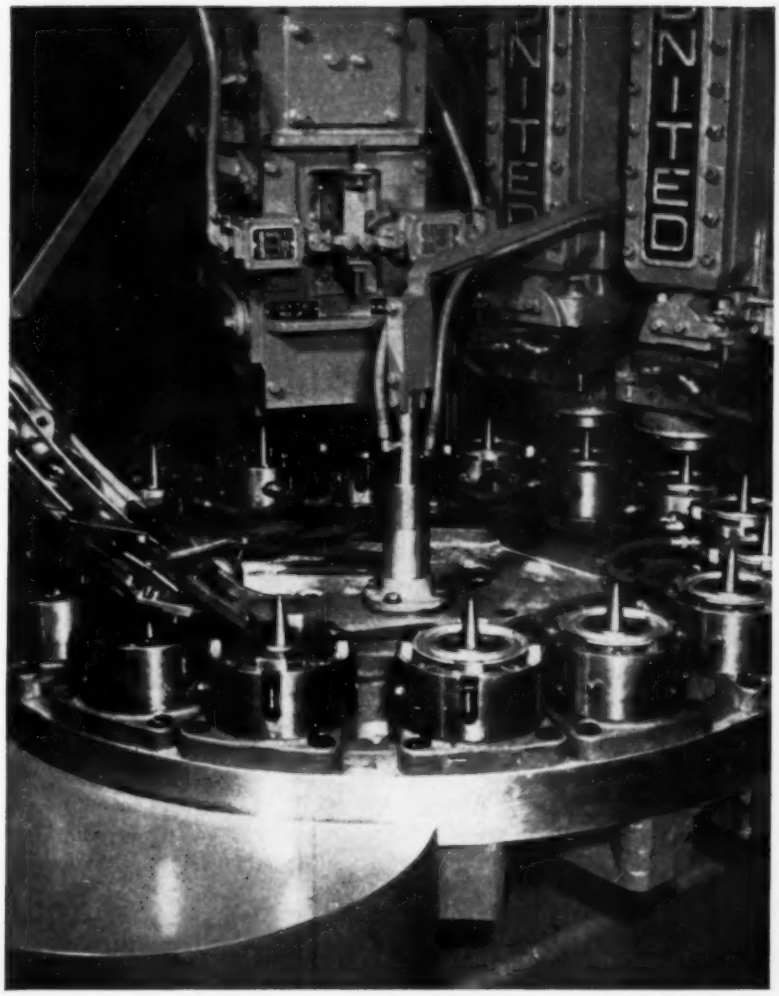
DOW | METAL PRODUCTS

10¢ PHONE CALL CUT MACHINING TIME 50% ON 3-FT. INDEX TABLE!

Ordered-by-phone magnesium tooling plate disc replaced cast steel index table for machinery manufacturer . . . "as purchased" flatness cut previous machining time on this part in half . . . saved 50% on machining costs.

United Welders Inc., of Bay City, Michigan, recently replaced steel with magnesium tooling plate in making the precision index table, or dial, for their automatic 8 Station Dual Dial Welder. This machine is used in welding the bottom gasket retainer for an oil filter assembly in 1959 automobiles.

The dials previously were made of cast steel which required costly, time-consuming surface and edge machining to finish. The 2½ inch by 36 inch dials of magnesium tooling plate are now purchased rough-cut to size from the local Dow magnesium distributor, and are finished by simply edge truing and drilling. Because the as-purchased flatness completely eliminates need for surface machining, United's machining costs on this part have been cut by more than half. Production has been speeded, too, because magnesium's light weight makes the dials easy to handle during manufacture. Two men can easily lift and handle the light disc. Cranes or lift trucks aren't needed as they were with the previous steel dials.



LIGHTNESS CUTS POWER NEEDS 75%

In the United welder above, the dial starts and stops 500 times per hour during welding operations. This lightweight magnesium dial requires only a quarter of the power needed to operate the previous steel dial. It permits a drastic reduction in the cost and size of motor, speed reducer and other necessary driving elements.

RIGIDITY MEANS ACCURATE POSITIONING

United Welders employs a Geneva Stop Movement to position parts accurately under dual automatic spot welding heads. Magnesium's rigidity helps the dial retain close tolerances necessary for continued accuracy.

Magnesium tooling plate has other advantages, too. It costs less to buy than other lightweight tooling materials and can easily be welded. It can often be obtained ready-cut-to-shape from distributors, saving additional time in your shop.

Because magnesium tooling plate is uniformly flat, it can be used for almost all tooling jobs without surface machining. It's rolled and thermal flattened to close flatness tolerances . . . high dimensional stability keeps it flat in use.

MAGNESIUM TOOLING PLATE IS AVAILABLE FROM STOCK AT:

E. F. Bailey Company
Seattle, Washington

Clendenin Bros., Inc.
Baltimore, Maryland

Copper and Brass Sales, Inc.
Cleveland, Ohio; Detroit 12, Michigan

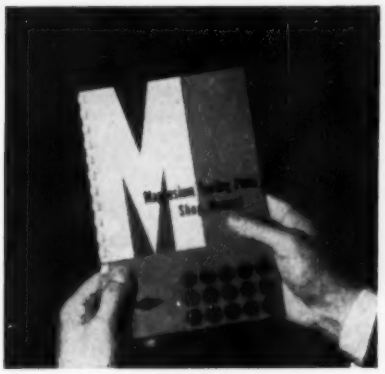
Fullerton Steel and Wire Company
Chicago 35, Illinois

Hubbell Metals Inc.
St. Louis 3, Mo.; Kansas City, Mo.; Marietta, Ga.

A. R. Purdy Co., Inc.
Lyndhurst, New Jersey

Reliance Magnesium Company
Los Angeles 58, California

Joseph T. Ryerson & Son, Inc.
Dallas, Texas



There's a wealth of information in Dow's new magnesium tooling plate manual. This handy 56-page book is filled with facts about shop working characteristics, machining, etc. For a copy, contact your Dow branch office or write to THE DOW METAL PRODUCTS COMPANY, Sales Department 1331F9-21.

THE DOW METAL PRODUCTS COMPANY, Midland, Michigan
DIVISION OF THE DOW CHEMICAL COMPANY

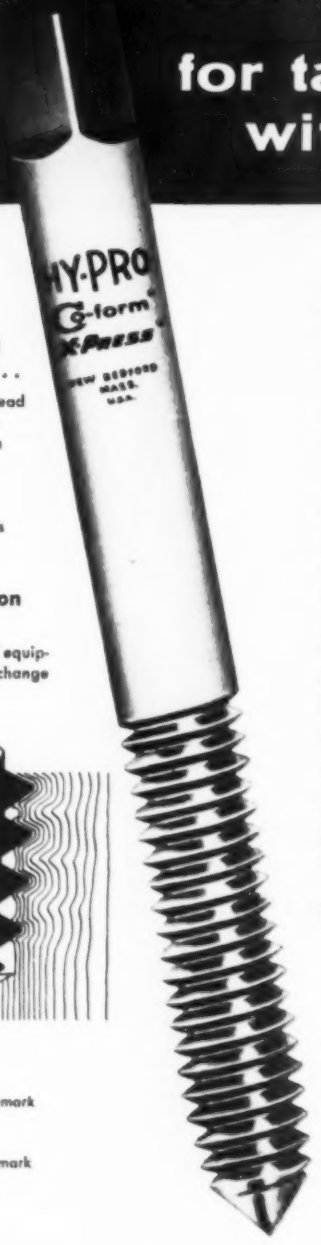
• 439 •

Announcing **HY-PRO**

Co-form® X-PRESS® TAPS

Manufactured under license from Besly-Welles Corporation

for tapping threads without cutting



Recommended for tapping . . .

Copper Brass Lead
Aluminum Zinc
Steel Magnesium
Die Castings
Leaded Steel
Stainless Steel
— other ductile metals

Tapping operation is the same

Conventional methods and equipment are used, except for change to larger tap drill sizes.

NOW — from HY-PRO you can get the newest in tap design — Co-form X-PRESS fluteless taps that are setting cost-reduction records on many jobs that were formerly "tap-killers".

HY-PRO Co-form X-PRESS taps cold-form threads in through or blind holes, with these advantages . . .

No Chips to clog and cause tap breakage — no chip removal problems • **Permit Faster Tapping Speed** and boost production from automatic equipment **Provide Accurate Control** of hole size — cannot be forced into lead error • **Eliminate Blind Hole Tapping Problems** — no chips to jam at bottom • **Form Stronger Threads** with better holding power • **Taps Are Stronger** without flutes, especially in smaller sizes **Taps Last Longer** and maintain accurate size tolerance **More Holes Per Tap** — up to 40 times greater tap life.

Try HY-PRO Co-form X-PRESS taps on your toughest tapping operations. For complete application information, call your HY-PRO Distributor or write: HY-PRO Tool Company, New Bedford, Mass.

Tap for less with Co-form® X-PRESS®

For the complete line of HY-PRO standard taps from stock, call your local HY-PRO Distributor.

® Co-form is a registered trademark of Hy-Pro Tool Company.

® X-Press is a registered trademark of Besly-Welles Corporation.

HY-PRO TOOL COMPANY
NEW BEDFORD, MASS., U. S. A.

Grinding connecting rod bolts to a 4 micro-inch finish, this cylindrical grinder is using Gulfcut Heavy Duty Soluble Oil, in emulsion concentration of 32:1. Workpiece is of 4140 steel. Speed: 225 sfm. Dept of cut: .020" with 30" x 1" aluminum oxide wheel.

Here are latest machining reports of Gulfcut performance . . . see how GULF MAKES THINGS RUN BETTER!

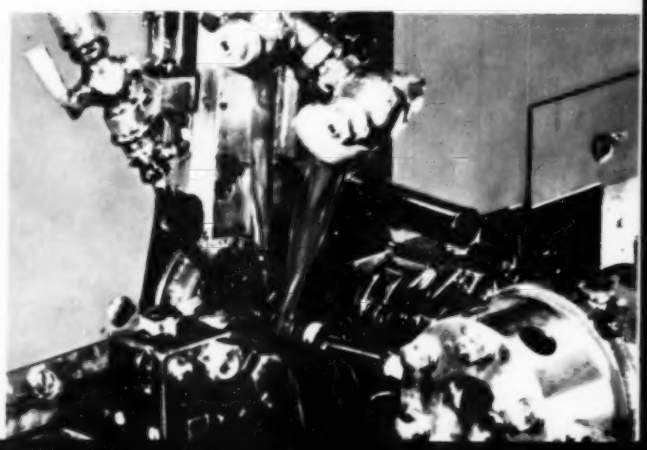
The relatively light color and transparency of Gulfcut 21C permit close inspection of the work in progress on this gear shaper. Gear being cut is of 4815 steel.

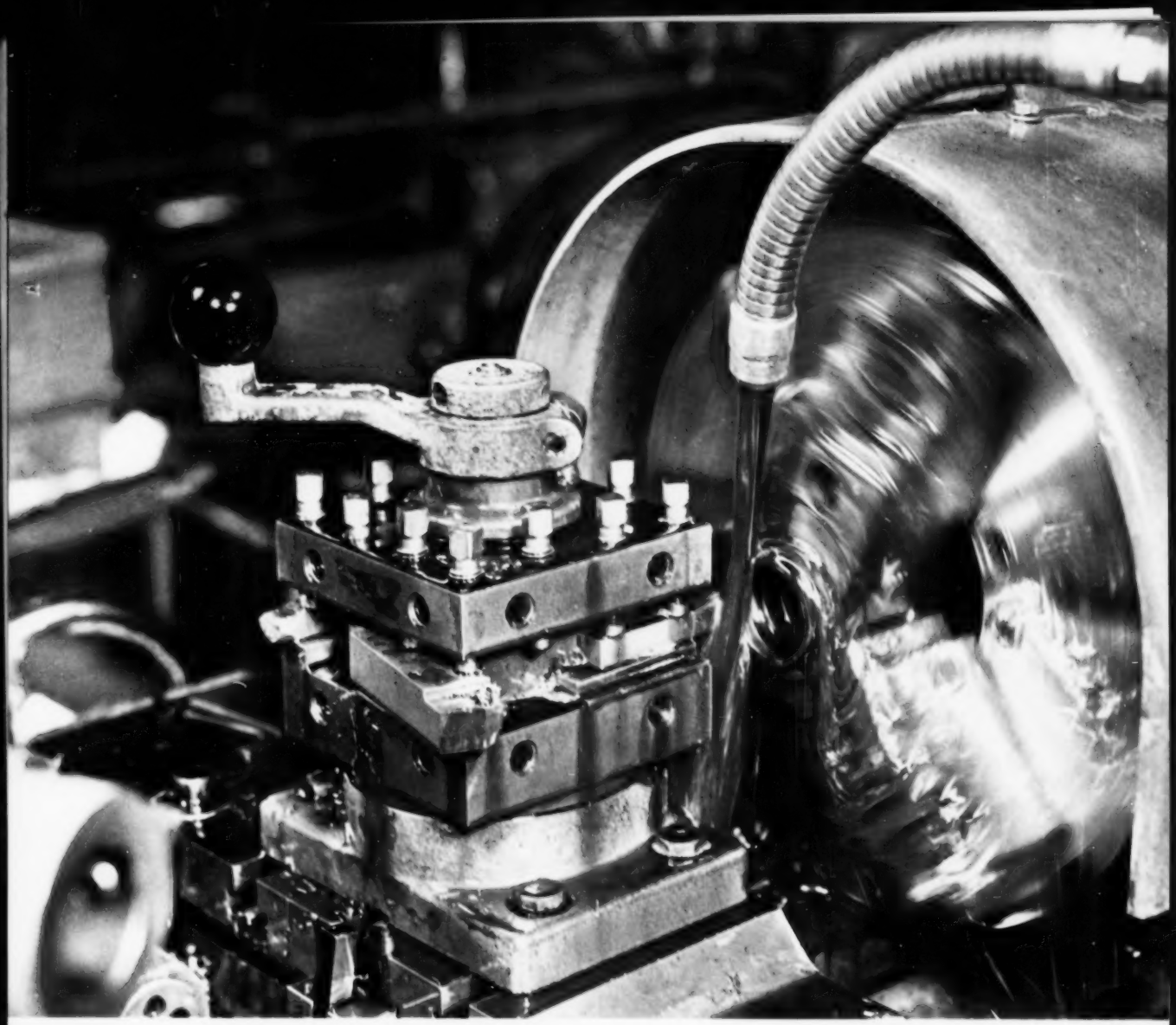
Gulfcut users report better results over a wide range of machining operations

There's impressive evidence of better results with Gulfcut oils in reports from hundreds of satisfied users. Results like these, that add up to lower machining costs: longer tool life, heavier cuts at higher speeds, finer finishes, closer tolerances, extended oil life.

You name the job . . . there's a Gulfcut oil to help you do it more efficiently at less cost. Choose from 10 types of shop-tested oils in 17 different Gulfcut grades. The Gulfcut line includes mineral-lard oils . . . sulfurized-mineral oils . . . sulfurized-mineral-lard oils . . . sulfo-chlorinated-lard oils . . . two types of emulsifying oils.

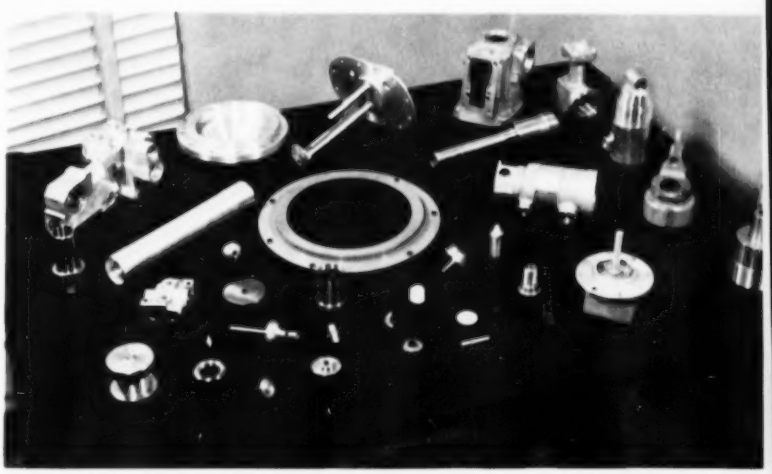
Let us have an opportunity to demonstrate what these products can do. You'll see plenty of proof that Gulf makes things run better.



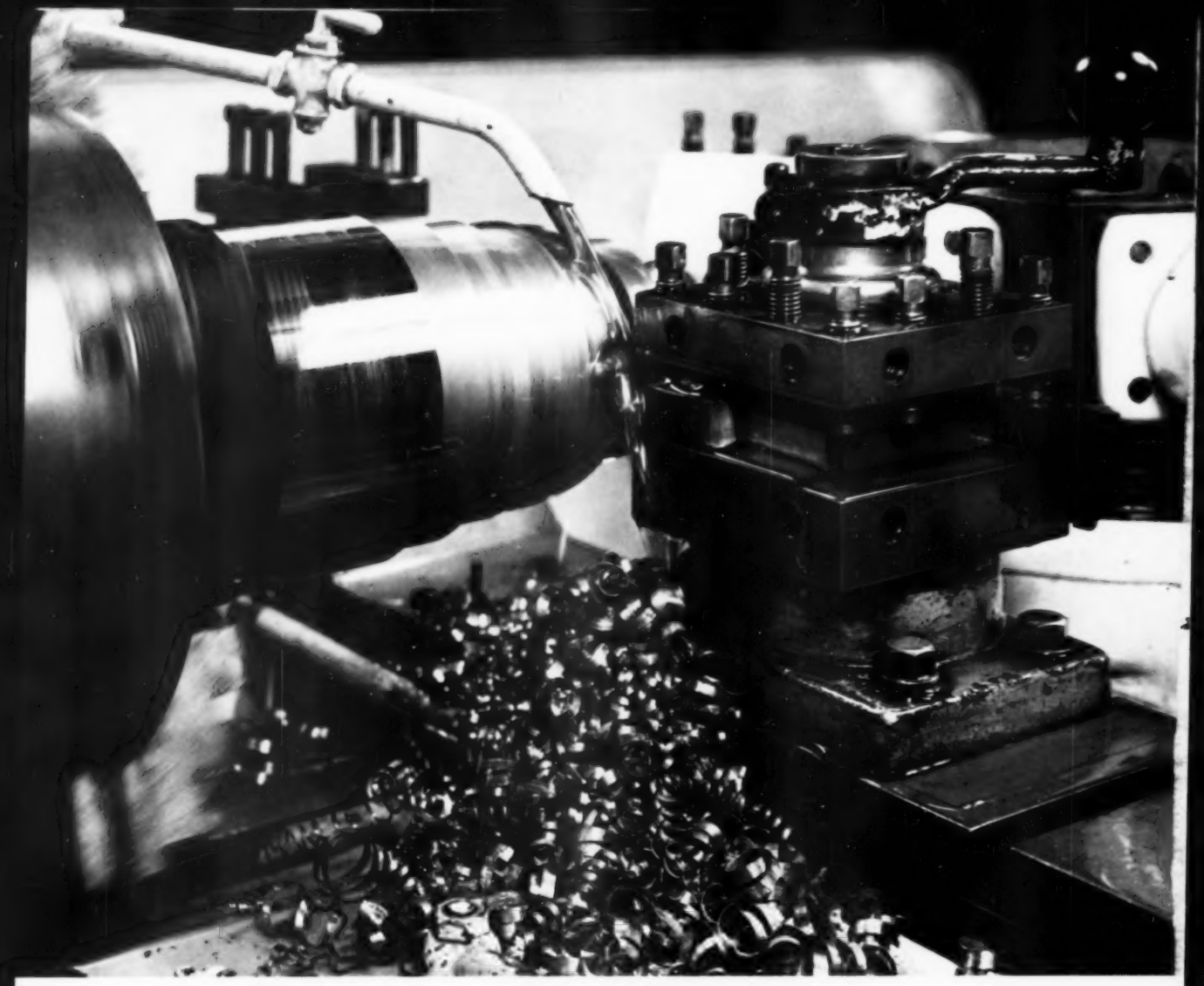


"We like the tough machining jobs—and do them with Gulfcut," says M&O Tool and Manufacturing Company, Wallingford, Connecticut. Here they're using Gulfcut 11D in a turret lathe to machine aluminum aircraft parts to a fine microfinish without additional lapping or grinding. Gulfcut oils help this company hold tolerances of .0005" on aluminum, titanium, monel, inconel, and many grades of stainless steel.

Some of the intricate and difficult parts machined at M&O Tool and Manufacturing Company for the aircraft and electronic fields, with the aid of Gulfcut 11D, 31C and 45B.



"Excellent finishes and outstanding tool life with Gulfcut 31C." That's the report from Bar-Work Manufacturing Company, Waterbury, Connecticut. A jobbing screw machine shop, Bar-Work is proud of its reputation for turning out precision work. Gulfcut 31C is used here in all steel machining operations.



Non-ferrous metals don't stain when you use Gulfcut 11A, shown here at work in a universal turret lathe. Gulfcut 11A is a non-corrosive, non-staining, mineral-lard oil recommended for machining non-ferrous metals.

NEW 100-PAGE MANUAL gives full information on selection and usage of cutting oils. Mail coupon for your free copy of "Metal Machining with Cutting Fluids." Also let us send you product bulletins on Gulfcut oils.

GULF OIL CORPORATION
Dept. DM, Gulf Building
Pittsburgh 30, Pa.

- ☐ Send me new cutting oil manual.
- ☐ Send bulletins on Gulfcut oils.

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Address
City Zone State

SP-8635

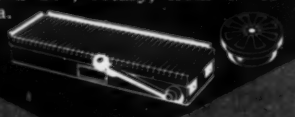
GULF

GULF MAKES THINGS RUN BETTER!

World's largest, most complete line of permanent and electro-magnetic and vacuum chucks

Walker Chucks are designed and engineered to give efficient and completely dependable performance in all applications. The incomparable combination of structural and operating features makes Walker Chucks your best buy in every way.

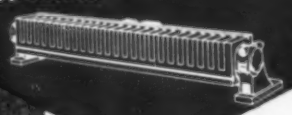
Walker permanent magnetic chucks utilize ceramic magnets which have *three times* the coercive force of alloy magnets. Rectangular chucks are available in 6 stock sizes, 6 x 10" to 12 x 24"; rotary, from 4" to 60" dia.



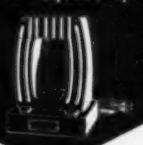
Small, thin work is easily handled with Walker bar pole electro-magnetic chucks. Rectangular in 81 sizes, from 6 x 12" to 30 x 96".

Holding jigs and fixtures are eliminated when you use Walker electro-magnetic chucks. Rectangular in 72 stock sizes, from 4 x 8" to 30 x 96"; rotary, from 6" to 36" dia.

In addition to the extensive range of stock sizes of permanent, electro-magnetic, and vacuum chucks and holding fixtures, Walker is your best source for "specials" for specific applications.



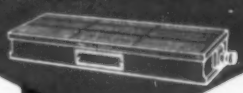
Walker has long been the leader in the field of demagnetizers. Stationary, hollow core demagnetizers are made to order in any size and shape of gap from 1" square up.



For complete information on the entire Walker line, write for Catalog No. 58.

O. S. WALKER COMPANY, INC.
WORCESTER 6, MASSACHUSETTS, U. S. A.

Walker vacuum chucks for holding non-ferrous parts are made to order in any desired size and shape. Favorites in the aircraft industry, they solve the problem of holding non-ferrous sheet stock. From 4" dia. to 10 ft. x 24 ft.



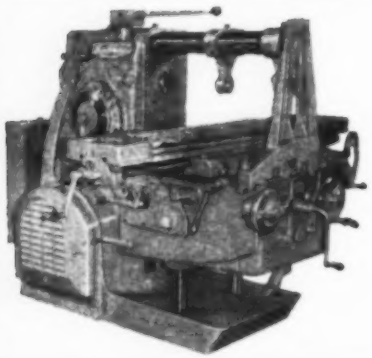
O. S. Walker

O. S. Walker – The Original Designers and Builders of Magnetic Chucks!

◄ CIRCLE 207 READER SERVICE CARD

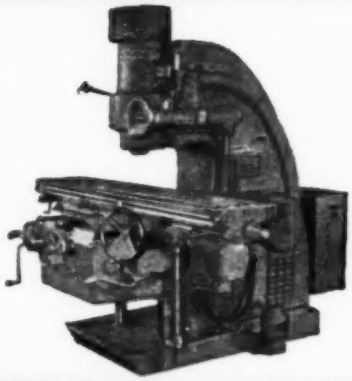
CIRCLE 208 READER SERVICE CARD

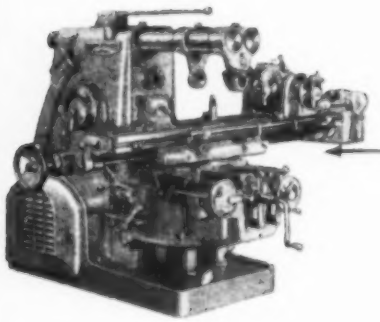
Kearney & Trecker machine tools quality...greater economy and



TF Series Line

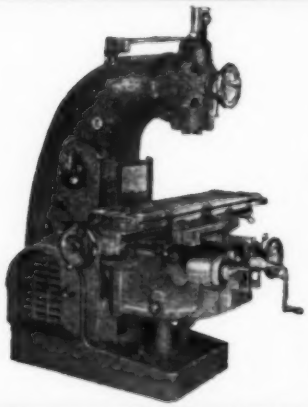
Strikingly new milling machines feature twin screw knee support for greater rigidity; new control center for ease of operation; improved Mono-Lever and Automatic Cycle Table Control; front-mounted backlash eliminator; adjustable saddle clamping gib; three bearing spindle that increases rigidity eight times over spindles without center bearing support, and many other features. TF's are available in five sizes Plain (left), Universal and Vertical (right) styles from 10hp to 50hp. (Catalog No. TF-50)

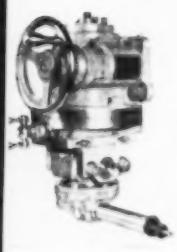




CH & CHL Milling Machines

These modern knee type milling machines incorporate the latest design and operating features... greater capacity for power, speeds and feeds. Machines are available in Plain, Universal and Vertical styles.. 3 to 10hp. (Catalog No. CH-3)



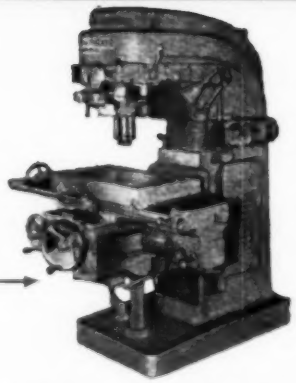


Attachments and Accessories

A complete selection for every milling requirement to convert standard machines into special purpose tools. Provide maximum productivity by supplementing with any of the various Kearney & Trecker standard attachments. Bulletins available on request.

Model 2D Rotary Head

Rotary head motion, combined with milling machine's ability to do boring, slotting, drilling, vertical milling, circular and angular milling, transmits complete blueprint into metal without changing setup. Speed range 250 to 4000 rpm; feed range .0002 to .008 ipr; rotary head feed range (16 changes) 2 to 3 rpm. (Catalog No. D-20)



TOOL-LEASE

Should you desire, you can conserve capital, reduce obsolescence using Kearney & Trecker's Tool Lease program. You can choose the machines you need from nearly 350 different standard milling and precision boring machines.

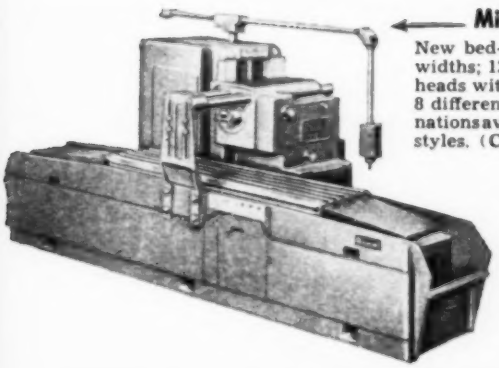
Designers and Builders of Precision and Production

offer you more productivity and performance than ever before...

TODAY, Kearney & Trecker gives you several complete new lines of knee and bed type milling machines, precision boring machines and special production machines to meet growing metalworking needs.

Note the *exclusive* twin-screw support of the massive knee and saddle on the new TF Series milling machines... the compact, central control grouping... profit-making features typical of the advanced design you'll find on every machine shown.

For complete information on these new machines, see our nearest representative. Ask for catalogs listed here, or write Dept. AM-99, Kearney & Trecker Corp., Milwaukee 14, Wis.

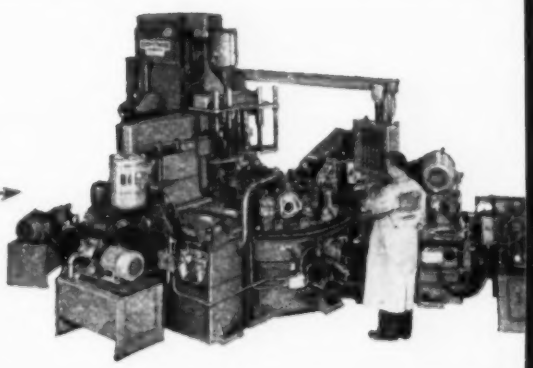


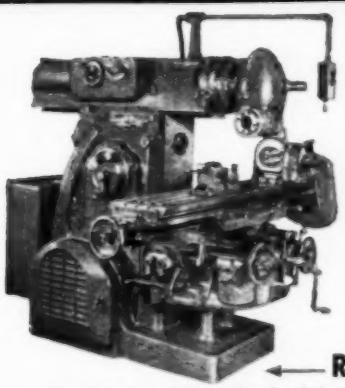
Mil-waukee-Mil Series

New bed-type design features: 4 table widths; 12 table sizes; 3 sizes of spindle heads with 3 speed ranges in each size; 8 different hp ratings. Over 300 combinations available in Simplex and Duplex styles. (Catalog No. MM-55)

Special Rotary Indexing and Transfer Machines

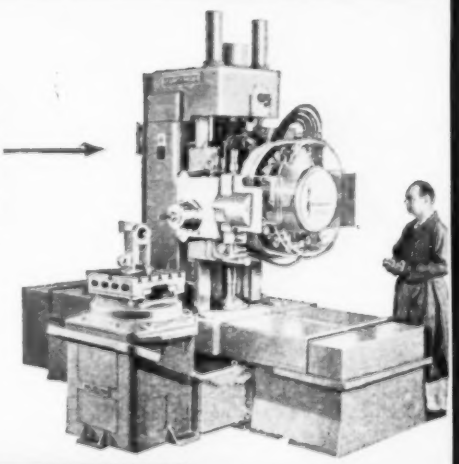
This 5-station rotary indexing machine features standard units: feed slides, quill feed, drill power units and rotary index table. Other special machines available. (Catalog No. SMD-10 and Data Sheet 1076)





Numerically controlled MILWAUKEE-MATIC

This single unit, tape-controlled machining center, unifies three basic processes — milling, drilling and boring. It is flexible automation of simple and complex machining operations on small- and medium-size lot production. Thirty-one tools are changed automatically on this new tape-controlled production machine. (Catalog No. TG-58)



Ram Head Milling Machines

Machine combines standard horizontal spindle with separate motor-driven vertical spindle mounted on sliding Ram. Ram may be equipped with either Universal, Vertical or Quill type head. Machines available in No. 2 to No. 4 sizes, Plain and Universal styles (Catalog No. RH-10)

Machine Tools Since 1898

KEARNEY & TRECKER MILWAUKEE

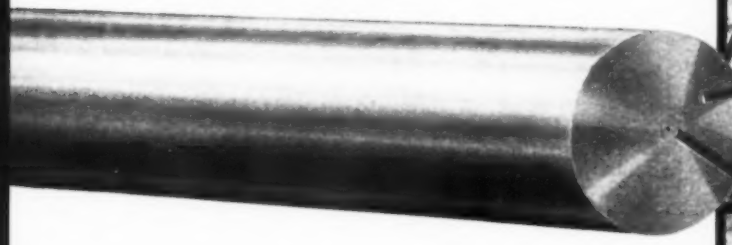
La Salle fatigue-proof STEEL BARS

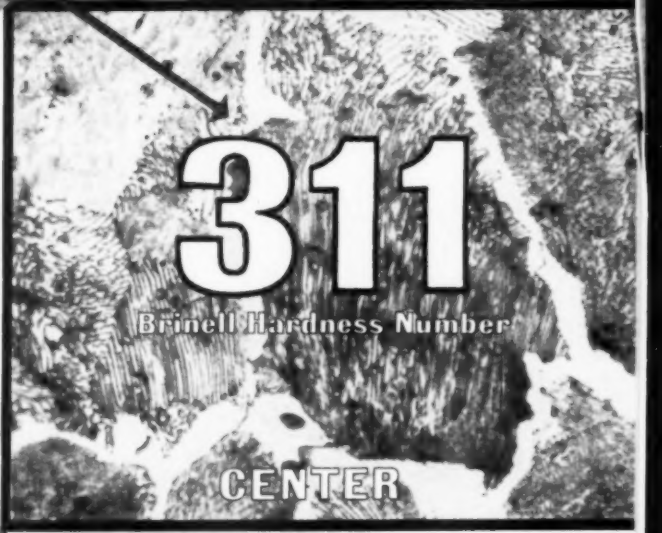
MADE BY e.t.d. PROCESS
Elevated Temperature Drawing

HAVE A UNIQUE COMBINATION OF

uniform properties

HIGH STRENGTH, MACHINABILITY, RESISTANCE TO WEAR AND FATIGUE, DIMENSIONAL STABILITY





1⅛" round FATIGUE-PROOF. Magnification: 750X

The microscope shows the uniformity of FATIGUE-PROOF. Its uniformly pearlitic structure parallels its uniformity of properties from the surface to the center of the bar.

FATIGUE-PROOF strength and hardness are developed by "e.t.d." (Elevated Temperature Drawing). Unlike quenching and tempering, its effect is the same from surface to the center of the bar. It works a large bar as uniformly as it does a small bar.

There is no mass effect.

The microscope proves it. Surface, center, or mid-radius, FATIGUE-PROOF is pearlitic. There are no mixtures of bainite, martensite, and pearlite. FATIGUE-PROOF is uniform bar to bar, size to size, and lot to lot.

T. M.—Trade-marks of La Salle Steel Company

24-PAGE BROCHURE—Request your copy, "A new material". . . . it tells the complete story of FATIGUE-PROOF.

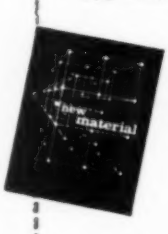
Name_____

Company_____

Address_____

City_____ Zone____ State_____

Mail to La Salle Steel Co., 1416 150th St., Hammond, Ind.



La Salle STEEL CO.

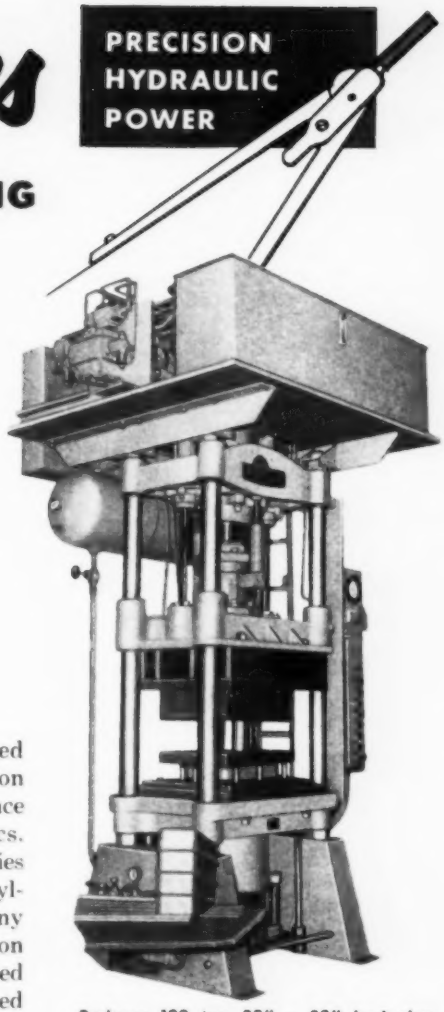
1416 150th Street • Hammond, Indiana

Manufacturers of America's Most Complete Line of Quality Cold-Finished Steel Bars

Rodgers Presses

PRECISION HYDRAULIC POWER

FOR METAL FORMING and DRAWING



Rodgers 100 ton 30" x 30" bed size with complete one cycle automatic control for deep drawing.

From Rodgers "Standard" Line Select your "Custom" Model

Easy as A B C:

A *Determine Press Tonnage and Style Press You Need*

B *Bed and Frame Size Required... Solid or Open Bolster*

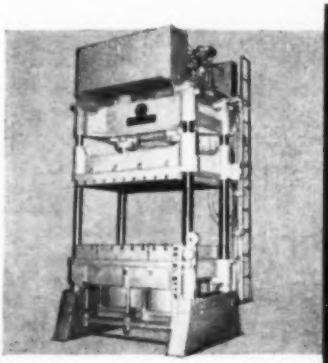
C *Select Pump Unit and Controls To Give Speed You Want*

The New Standard line of Rodgers Platen Presses has been designed to greatly simplify press selection. From the basic press styles, one may be selected and combined with varied pumps and controls, automatic, semi-automatic or pressure sensitive, to give the desired speed and performance. This results in savings of "custom" engineering and costs.

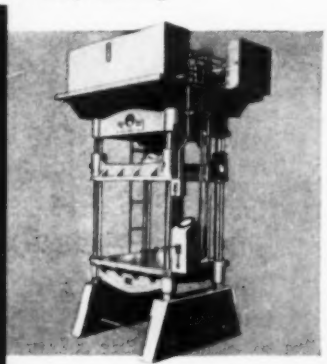
Rodgers Presses are designed and built by an organization with over 32 years' experience in high pressure hydraulics. They are available in capacities from 50 to 400 tons, single cylinder or twin cylinders, in many standard models for production or special uses. Where desired custom models will be designed to suit exacting special requirements.

SEND FOR *NEW* CATALOG 337...

This new Rodgers Catalog has complete specifications, tables and data, making it simple to determine the press for the job. Write for your copy without obligation.



Rodgers twin cylinder, twin die cushion, 200 ton drawing press with 60" x 48" bed; single cycle automatic.



Rodgers 100 ton press, 36" x 36" bed with single lever pressure sensitive manual control.

HYDRAULICS Rodgers KEEP THE WORLD MOVING

RODGERS HYDRAULIC, Inc.

Pioneers in High Pressure Hydraulics Since 1932

7475 WALKER STREET · MINNEAPOLIS 26, MINNESOTA

NATIONAL ACME'S

"ZONE OF RESPONSIBILITY"
INCLUDES ALL PHASES OF COST REDUCTION

Check YOURS...Then Check National Acme

Direct Costs: these include direct dollar savings as realized by Minneapolis Honeywell . . . an "every day" job for Acme-Gridleys.

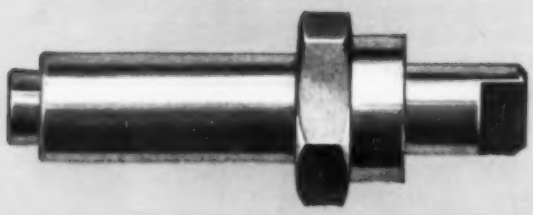
Indirect Costs: effecting important savings in maintenance, downtime, scrap reduction, tool costs, etc.

Product Redesign: teaming with your design group to take full advantage of Acme-Gridleys' cost reducing capabilities.

Direct Material Costs: our engineers provide important savings in this area by constantly matching machines and tools to modern metallurgical problems.

Make-or-Buy Reviews: in many cases our Contract Division can assume your production headaches and relieve you of immediate capital investment.

Spot Modernization: pioneering in modern tooling methods, and the flexibility of Acme-Gridleys can provide many "on-the-spot" savings.

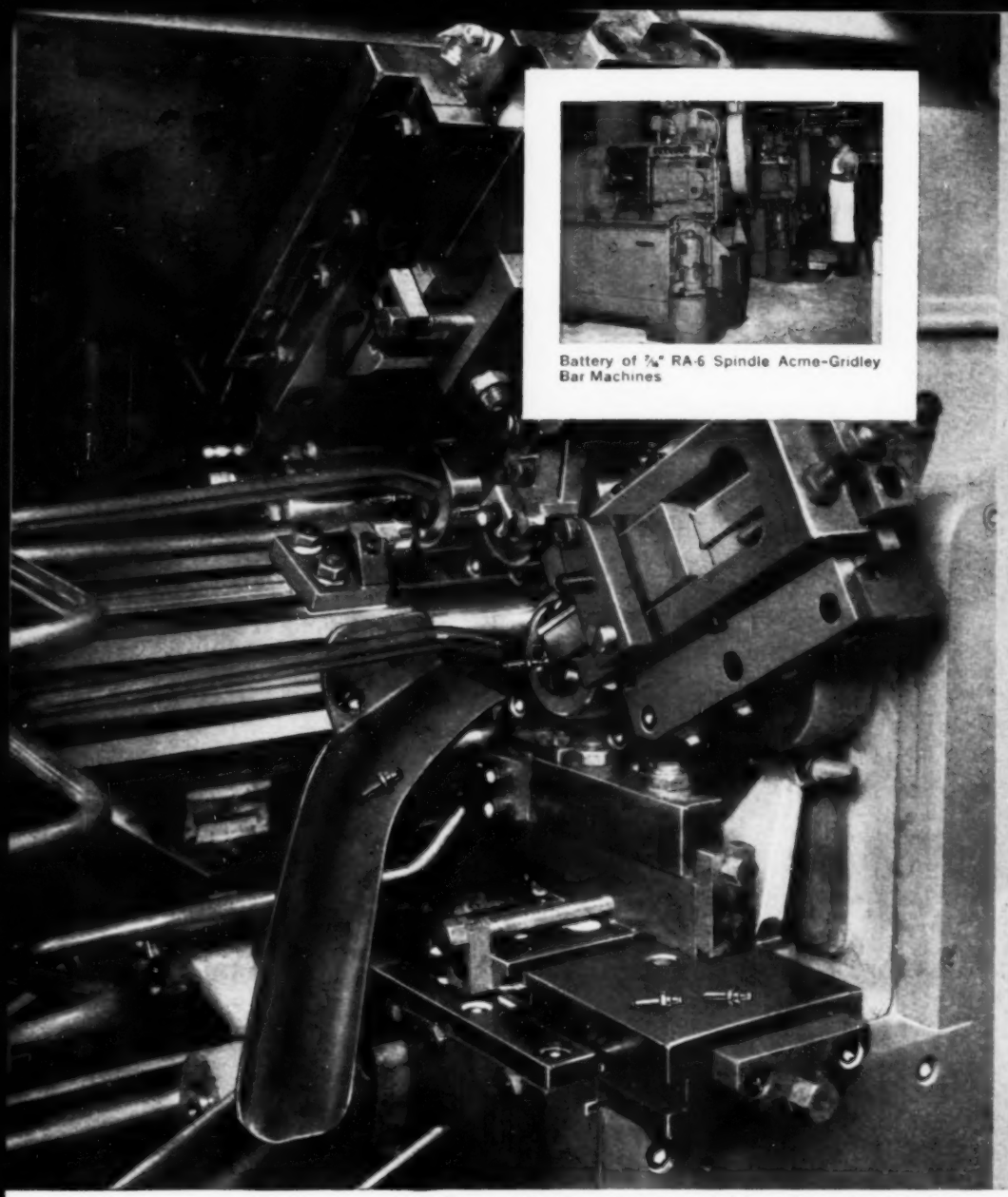


At Minneapolis Honeywell

ONE ACME-GRIDLEY REPLACES FIVE SINGLE SPINDLE MACHINES

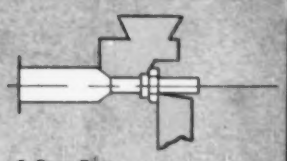
. . . Saves 200% in Machine Hours

CIRCLE 213 READER SERVICE CARD

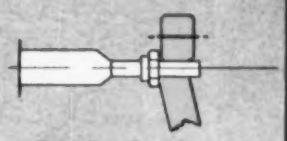


Battery of 7/8" RA-6 Spindle Acme-Gridley Bar Machines

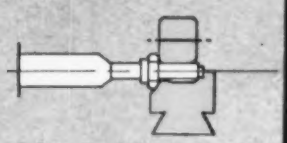
7 Operations in 8.75 Seconds



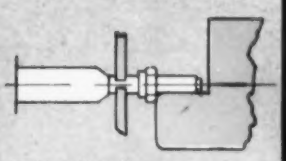
6. Form Rear—Rough Turn—Front Dia.



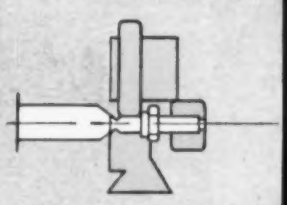
1. Finish Turn Front Dia.



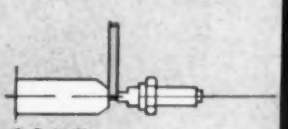
2. Form Small Dia. and Face End—Support



3. Stop Spindle—Cross Mill Flats—Support



4. Start Spindle—Shave Rear Dia.



5. Cut off

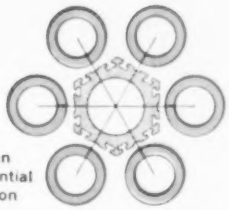
Close up of tooling zone showing 3rd, 4th and 5th position operations

. . . *in addition* the reject rate is reduced 200% and operator hours slashed 300% in the production of a precision center post component for residential thermostats. What's more, with one machine, one set of tools, and one operator doing all machining in the primary setup, quality control is greatly simplified, and valuable floor space saved. Still further savings result from greatly reduced machine maintenance.

Such drastic savings are possible for Minneapolis Honeywell because of inherent Acme-Gridley features such as independently operated tool slides, the extreme accuracy and flexibility of direct camming, and wide open tooling zones. Rugged and versatile 7/16" Acme-Gridleys fit right in with Honeywell's program of "Total Machine Utilization"; will pay off for years to come by economically accommodating the materials and setups Honeywell requires in the production of small, high quality parts for their precision instruments.

Get the complete story on how Acme-Gridley Automatics provide industry's most modern approach to cost reduction. Call, write or wire.

CIRCLE 214 READER SERVICE CARD

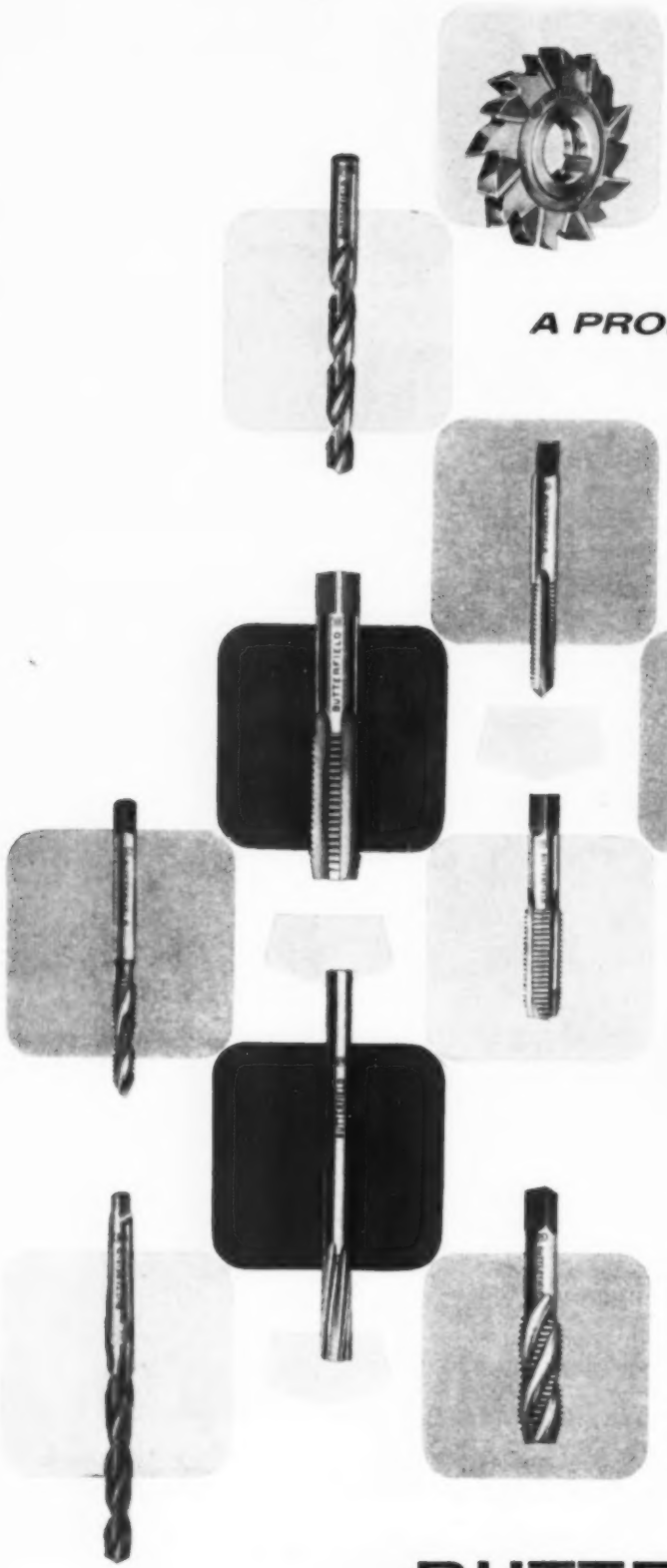


Pioneer in Circumferential Automation

National Acme

The National Acme Company
171 E. 131st Street
Cleveland 8, Ohio

Sales Offices: Newark 2, N. J.; Chicago 6, Ill.; Detroit 27, Mich.



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BUTTERFIELD
100% INSPECTED TOOLS

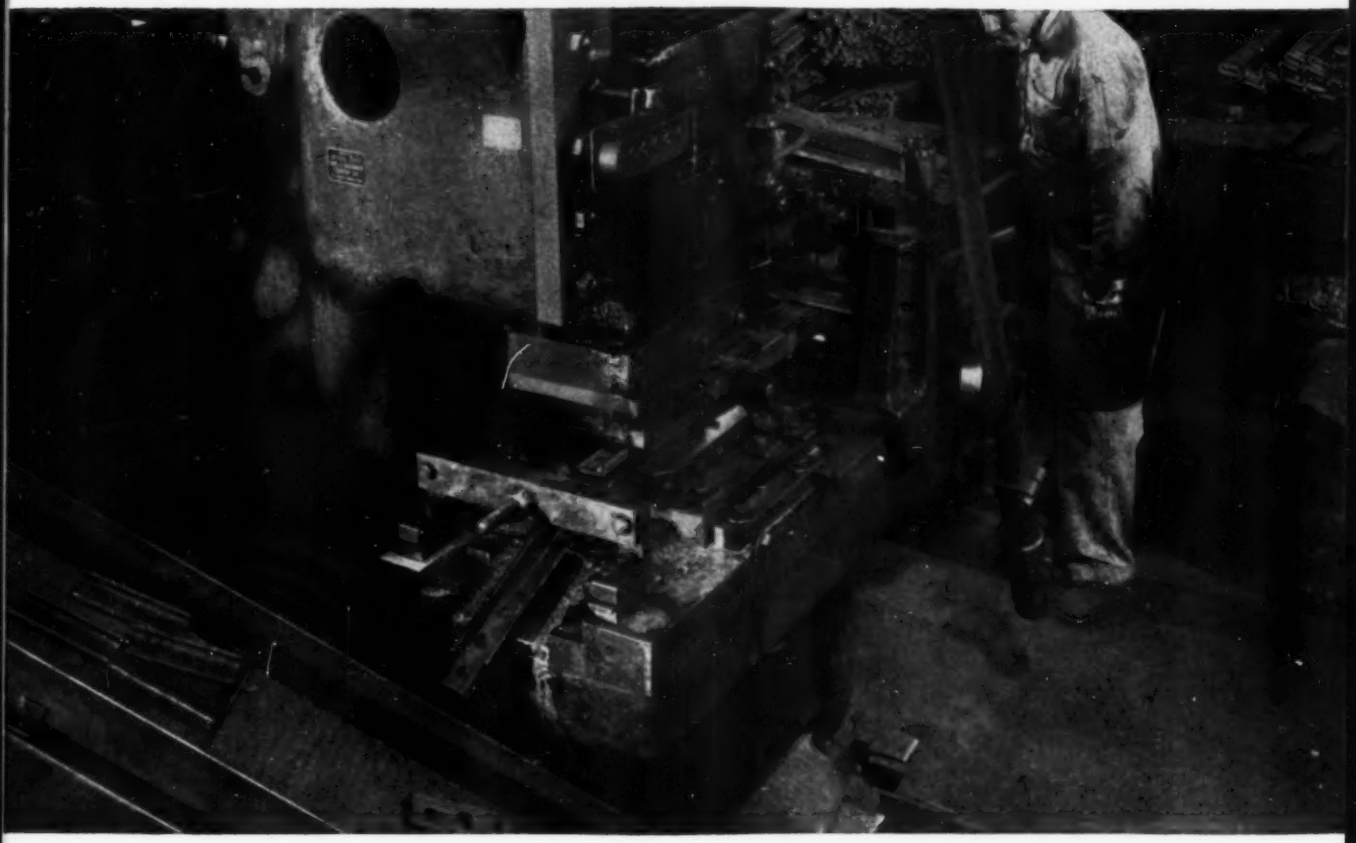
the complete line

You name it — Butterfield has everything you want in cutting tools — and can get them to you fast wherever you want them. Taps, dies, counterbores, cutters, drills, reamers, end mills, hobs and carbide tools. Warehouses in Chicago, Cleveland, Detroit, Fort Worth, Los Angeles, New York and San Francisco. **See your Butterfield Distributor.**

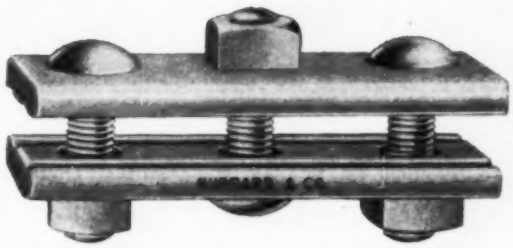
BUTTERFIELD

BUTTERFIELD DIVISION, UNION TWIST DRILL COMPANY, DERBY LINE, VERMONT

STEEL SHAPED TO CUT COSTS AND IMPROVE PRODUCTS



One automatic operation punches three holes and shears off the part from a USS Hot-Rolled Special Section. No machining necessary.



Hubbard pole line hardware made from USS Special Sections.

Pole line hardware • one punch • made from USS Special Sections

Hubbard and Company is one of the largest pole line hardware manufacturers in this country. They turn out guy clamps, cable suspension clamps and lashing clamps by the thousands. To keep production costs low, they use USS Special Sections already rolled to the proper cross section for the finished piece.

Many items can be punched and sheared in one automatic operation so that there is no machining and very little scrap. Parts can then be galvanized, bolts inserted and the job completed.

How USS Special Sections can reduce your costs. If you have an irregular steel part that must be produced in quantity at low cost, let us check your drawings. Many times a complex and costly assembly can be replaced by the use of one USS Hot-Rolled Special Section. Designs are unlimited. Write for our new book showing many intricate shapes already being produced. United States Steel, 525 William Penn Place, Pittsburgh 30, Pa.

USS is a registered trademark

United States Steel Corporation—Pittsburgh
Columbia-Geneva Steel—San Francisco
Tennessee Coal & Iron—Fairfield, Alabama
United States Steel Export Company

United States Steel

This is a MARVEL High-Speed-Edge Hack Saw Blade Cutting a 4" x 4" Titanium Billet

EVERYTHING'S IMPROVED BUT THE GUARANTEE

33 years ago, MARVEL introduced the first welded-edge hack saw blades . . . guaranteed them to be shatterproof . . . and a new concept of power hack sawing came into existence.

In combining, by welding, two materials—a narrow, high speed steel cutting edge, and a tough alloy steel body, MARVEL pioneered the modern hack saw blade.

When operators learned they could apply the heaviest feed pressures and highest speeds to the new MARVEL Blades with complete confidence that they would never shatter or "explode" to cause them personal injury, hack sawing began the approach to its present high level of efficiency. Even cutting "exotic" metals, such as titanium, where heavier feed pressures are a necessity, the MARVEL Blade does an outstanding job and is completely safe.

Today's MARVEL High-Speed-Edge Hack Saw Blades are greatly improved, even over the MARVEL Blades which were the best on the market a few years ago. Advanced metallurgy has produced better steels; new heat treating and manufacturing techniques have brought further improvements. The only thing unchanged is the Guarantee: THEY ARE SHATTERPROOF!

If you haven't used MARVEL High-Speed-Edge Hack Saw Blades recently, try them on your saws for a month and see the difference a truly superior blade can mean in higher speeds, greater accuracy, lower cost per cut, and guaranteed safety to operating personnel. Your nearby MARVEL Distributor carries a complete stock of MARVEL High-Speed-Edge Blades.

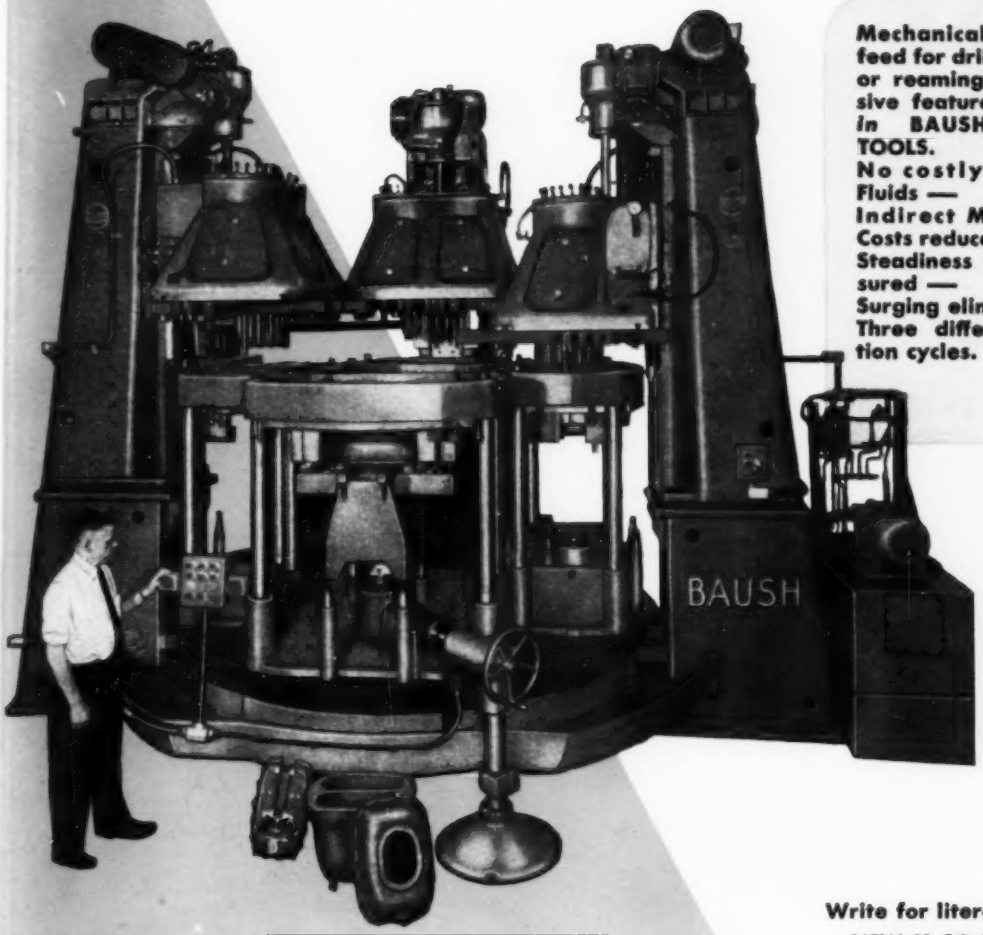
Write for Bulletin CT-175 which has complete details on MARVEL High-Speed-Edge Hack Saw Blades.

ARMSTRONG-BLUM MFG. CO.
5700 W. BLOOMINGDALE AVE., CHICAGO 39, ILL.

MARVEL *Metal Cutting* **SAWS**
Better Machines—Better Blades

VERSATILE MECHANICAL LEADSCREW MACHINE

With Master Fixture Holding Units and Mounting Plates, Drills, Taps and Reams 39 Different Parts of Gas Meter Accurately and Economically



Mechanical Leadscrew feed for drilling, tapping or reaming is an exclusive feature *found only in* BAUSH MACHINE TOOLS.
No costly Hydraulic Fluids —
Indirect Maintenance Costs reduced —
Steadiness of feed insured —
Surging eliminated —
Three different production cycles.

SPECIFICATIONS:

Each of three vertical columns mounts an M-20 Mechanical Leadscrew Machine. The 124" diam. Semi-Automatic Hydraulic Rotary Indexing Table has four stations. M-20 Units are mounted at Stations 2 - 3 and 4. Each head is 27" x 40" and is bored for 32 spindles with 32 upper spindle drivers 1½" in diam. arranged for 2 speeds and a neutral position. Both feed and spindle speed are variable . . feed can be varied from .005 per Rev. Low to .090 per Rev. High, and spindle speeds from 130 RPM to 1050 RPM.

Feed is thru ball screw direct from spindle driving gears. When a head goes from rapid traverse to feed stroke an electric brake holds leadscrew and shuts off traverse motor — saving wear and tear. Heads have automatic high production cycle — semi-automatic low production cycle, and a jog cycle for set-up. Machine has 98 spindles and adjustable arms. Operation sequence is:

Station 1 — Unload and load
Station 2 — Multiple Drilling
Station 3 — Multiple drilling, chamfering and reaming.
Station 4 — Multiple Tapping (Master Leadscrew Method)

Machine has:

3 — 20 HP 1800 RPM motors for spindle drives
3 — 1 HP 900 RPM motors for Rapid Traverse Heads
1 — 7½ HP 1200 RPM motor operating Rotary Table.

Write for literature on this NEW M-20 MECHANICAL LEADSCREW machine NOW. Send us your problems — our Engineers can help you.

BAUSH
MACHINE TOOL CO.
SPRINGFIELD 7, MASSACHUSETTS

NEW HAMPSHIRE BALL BEARINGS, INC.
PETERBOROUGH - NEW HAMPSHIRE

ARTHUR N. DANIELS
PRESIDENT

July 13, 1959

Mr. N. A. Leyds, General Manager
Bryant Chucking Grinder Company
Springfield, Vermont

Dear Mr. Leyds:

It is a pleasure to congratulate you for your Company's development of the new miniature Centalign internal grinders, from our point of view the outstanding machine tool design of the past ten years.

I feel that your engineers, designers, production people and those who made this decision are to be highly commended for this achievement.

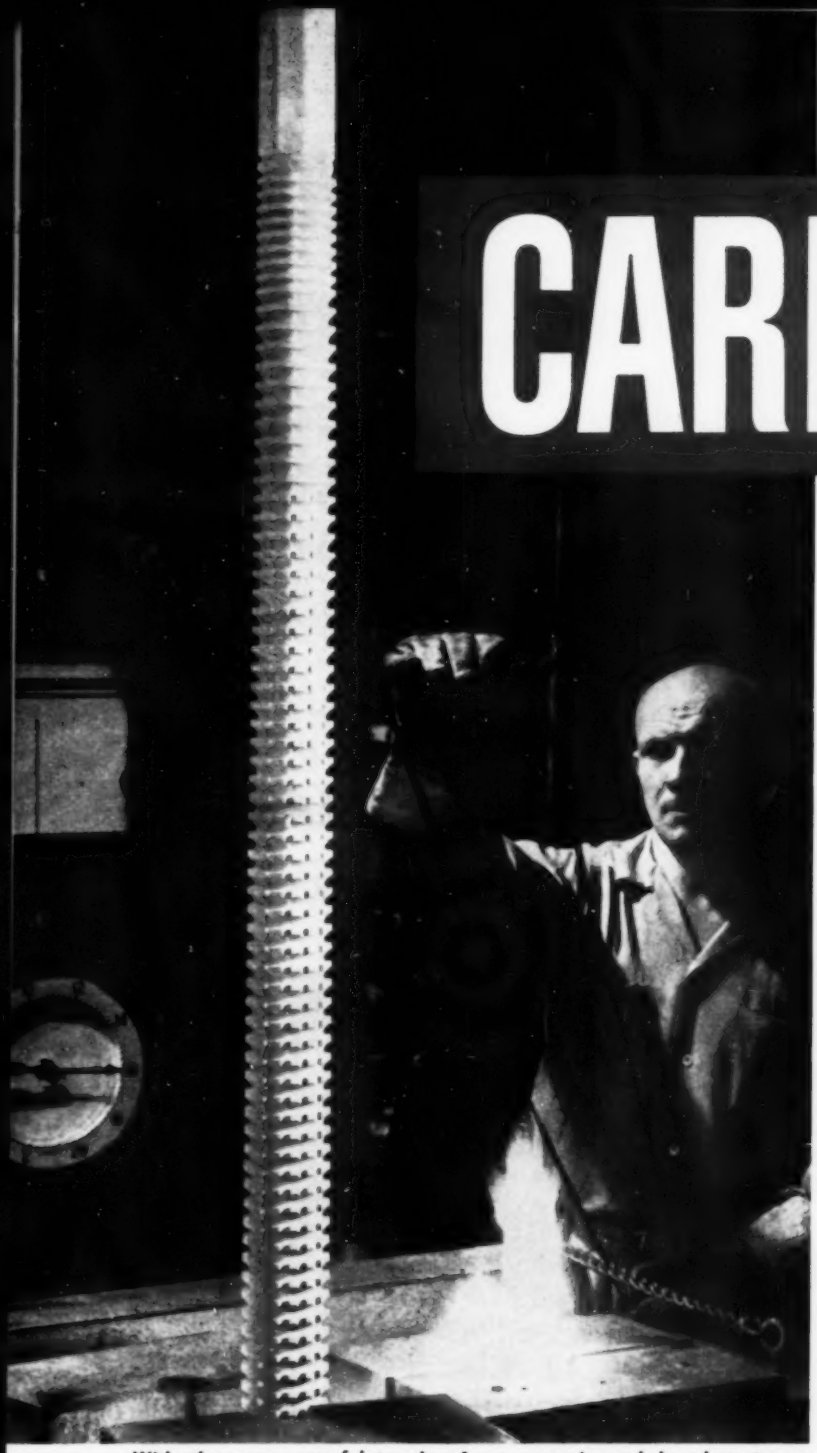
Sincerely,

A. N. Daniels
President

AND/im

BRYANT CENTALIGN®

CAREFUL!



With the sure, *careful* touch of an experienced hand, veteran CTW heat-treat man hoists 72" broach from a vertical furnace.

Care in the creation of Continental Broaches takes precision manufacturing a step beyond the exactness of quality control. Thirty years of broachmaking—designing and producing thousands of standard and custom-made broaches—assures *unmatched* efficiency and performance from CTW Broaches.

Find out how Continental's experience in broach engineering, modern heat treat methods and cost-saving production processes can cut downtime and increase output in your operation. Call your local Ex-Cell-O representative, or contact Ex-Cell-O Detroit; in Canada, Colonial Tool Co., Ltd., Windsor.

59-14

CTW Continental TOOL WORKS

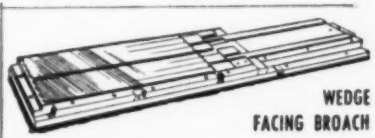
DIVISION OF

EX-CELL-O CORPORATION

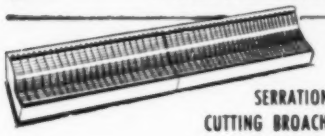
DETROIT 32, MICHIGAN

PINETREE FORM BROACH

SPIRAL SPLINE BROACH

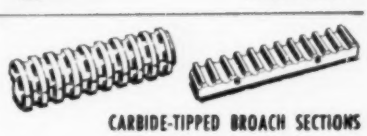


WEDGE FACING BROACH

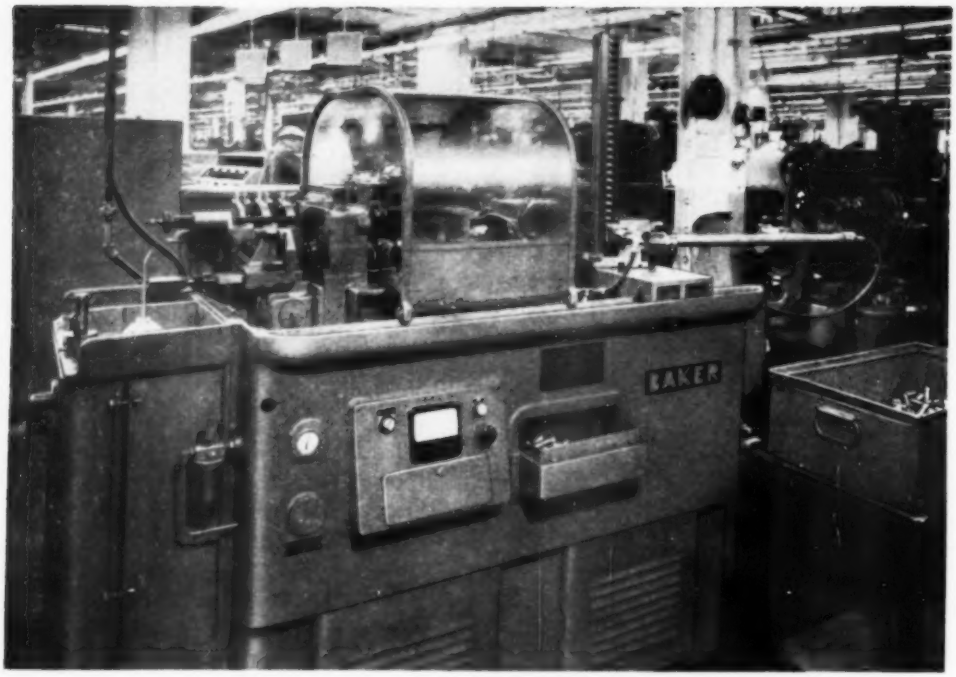


SERRATION CUTTING BROACH

INVOLUTE SPLINE SHELL-TYPE BROACH



CARBIDE-TIPPED BROACH SECTIONS



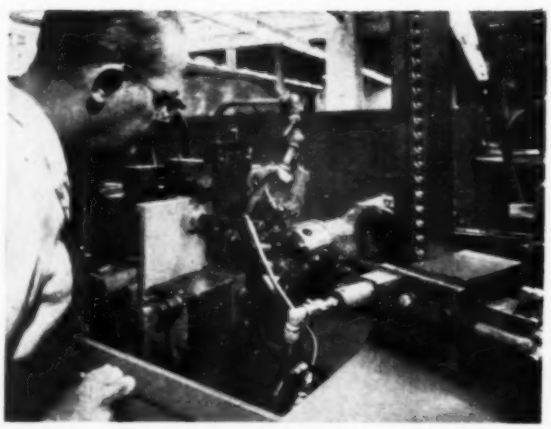
At American Bosch this BAKER® boosted production 300%

The greater speed and ease of operation of the BAKER has given a 300% increase in the production of delivery valve holders, according to American Bosch Division, Springfield, Massachusetts. This leading manufacturer of Diesel fuel injection systems bought the BAKER AUTOMATIC BAR MACHINES two years ago as replacements for manual machines.

"With a manual machine," reports the foreman in charge, "the operator had to change gears to increase or decrease the rpm. The job took ten minutes. With the BAKER, he merely turns a dial. The BAKER, running three shifts, *paid for itself in one year.*"

The former manual machines required an operator for each. Now, one man operates five BAKER machines.

For details on how BAKER AUTOMATIC BAR MACHINES can increase production and cut costs in your plant, write BAKER BROTHERS, INC., DEPT. AB-959, 1000 POST STREET, TOLEDO 10, OHIO.

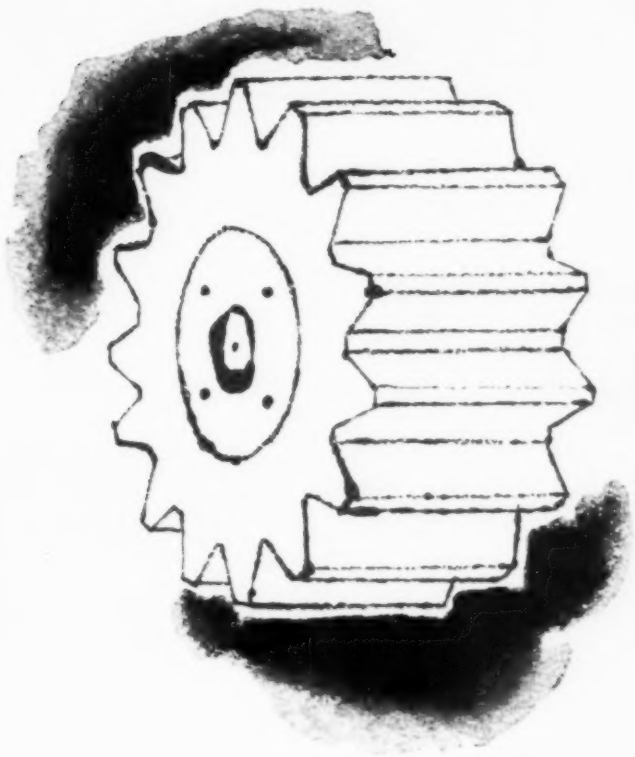


BAKER AUTOMATIC BAR MACHINE producing delivery valve holders at American Bosch Division, Springfield, Mass. Machine maintains tolerance of .0005 with AISI 8620 steel in long runs.

BAKER®

AUTOMATIC BAR MACHINES

STANDARD AND SPECIAL DRILLING AND TAPPING MACHINES • COMPRESSION MOLDING MACHINES



Gears... Cutting Oils... and How to Save Money

The more gears your equipment can hob before tool change, the lower your cost of operation. Sinclair Ordnance Cutting Oils have earned the reputation for increasing tool life because of their high heat dissipation characteristic. Furthermore, a special E. P. agent assures the highest quality finish . . . more money saved through fewer rejects. Switch to Ordnance, now. Next time management asks how you've cut costs, tell them you've changed to Sinclair—and show them the results.

Sinclair

Call your Sinclair Representative for further information or write for free literature to Sinclair Refining Company, Technical Service Division, 600 Fifth Avenue, New York 20, N. Y. There is no obligation.

Sinclair
Ordnance Cutting Oils

Completely Satisfactory in Every Way

. . . says Mr. William H. Vogt, Division Superintendent of Parts and Tool Manufacturing at Taylor Instrument Companies, Rochester, N. Y.

NEW TYPE D Hand Feed SURFACE GRINDER

is ruggedly designed for precision work.

Taylor Instrument Companies

OFFICES IN ALL PRINCIPAL CITIES

For the Home: TEMPERATURE & WEATHER INSTRUMENTS — For Industry: TEMPERATURE, PRESSURE, HUMIDITY, FLOW & CONTROL INSTRUMENTS

SUBSIDIARIES IN TORONTO, CANADA; LONDON, ENGLAND; MELBOURNE, AUSTRALIA

95 ANDS STREET
ROCHESTER 1 N.Y. U.S.A.

May 7, 1959

Mr. John C. Wilson,
Vice-President, Sales & Engineering
The Thompson Grinder Company
Springfield, Ohio

Subject: THOMPSON Type D Surface Grinder

Dear John:

We have proven the new Thompson Type D Tool Room Grinder by rigid tests in our Tool Grinding Department. We find it completely satisfactory in every way.

We find these decided advantages on the new Thompson:

1. Its ease of adjustment
2. Its ruggedness and rigidity
3. Its bedway and column protection
4. Its large vertical capacity
5. Its cross-feed movement obtained by moving the wheel head rather than using a saddle, which permits accurate grinding of slots.

Everything considered, we find, in our work, the new Thompson Type D a very superior precision machine.

Yours very truly,

William H. Vogt

William H. Vogt
Division Superintendent
Parts and Tool Manufacturing

whv:lb

With men like Mr. Vogt, who rate tool room grinders solely on their performance, Thompson's new Type D machine is winning enthusiastic approval.

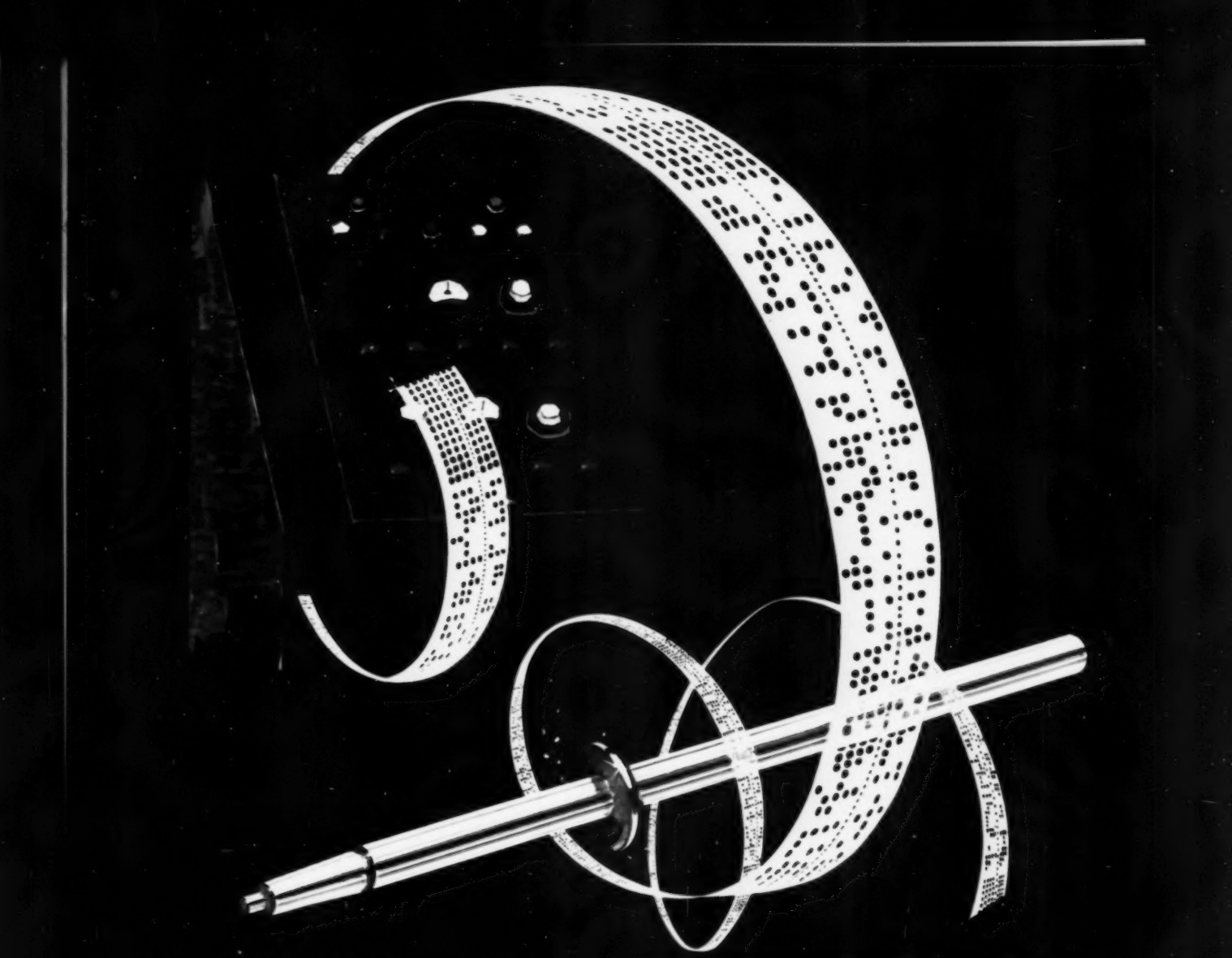
Send for descriptive literature on this new Type D machine and compare the advantages it offers you in cost-cutting time-saving and trouble-free performance. Immediate delivery is available.

THE THOMPSON GRINDER CO.

SPRINGFIELD, OHIO

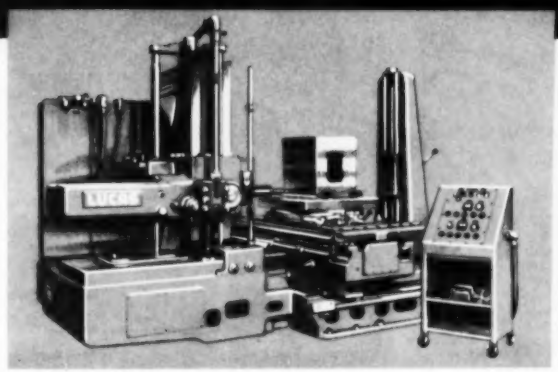
CIRCLE 223 READER SERVICE CARD

CIRCLE 224 READER SERVICE CARD ▶

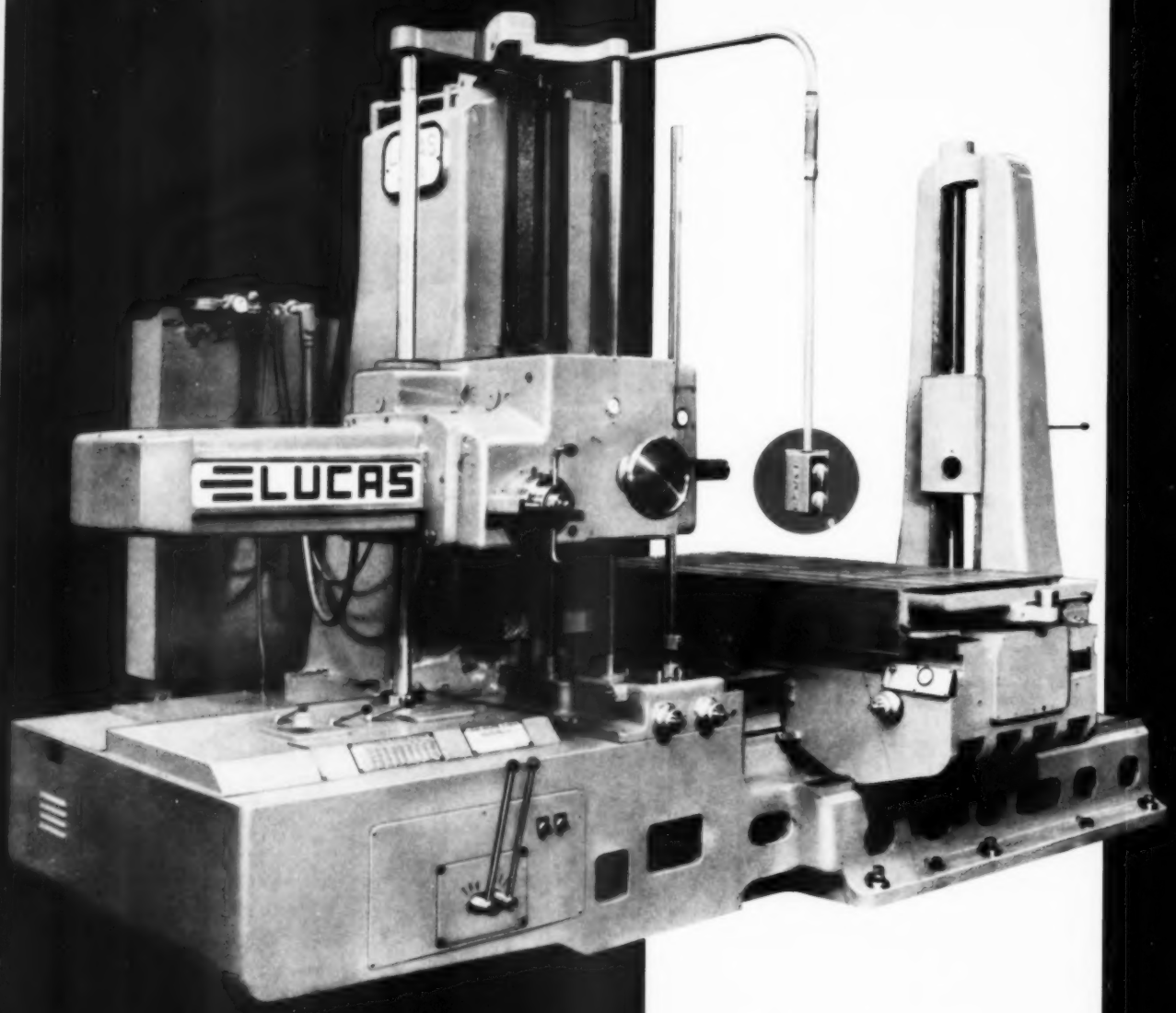


Tape control... certainly!

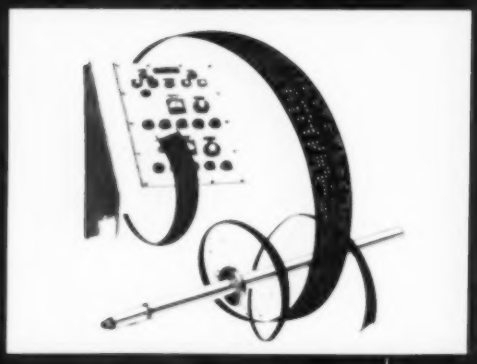
Tape control can readily be applied to any Lucas model, (2 3/4" to 6" diameter spindles) if repetitive operations or complicated one-of-a-kind jobs make this new development advantageous. Lucas tape controlled machines are available with punched tape for N.P.C., magnetic tape for contouring, or tape and tracer control. If you have a profitable use for *any* type or size of horizontal boring, drilling and milling machine (up to 6" spindle capacity) you can get it at its best from the specialist in this type of machine. *Did you ever meet a man who regretted picking a Lucas?*



LUCAS
OF CLEVELAND



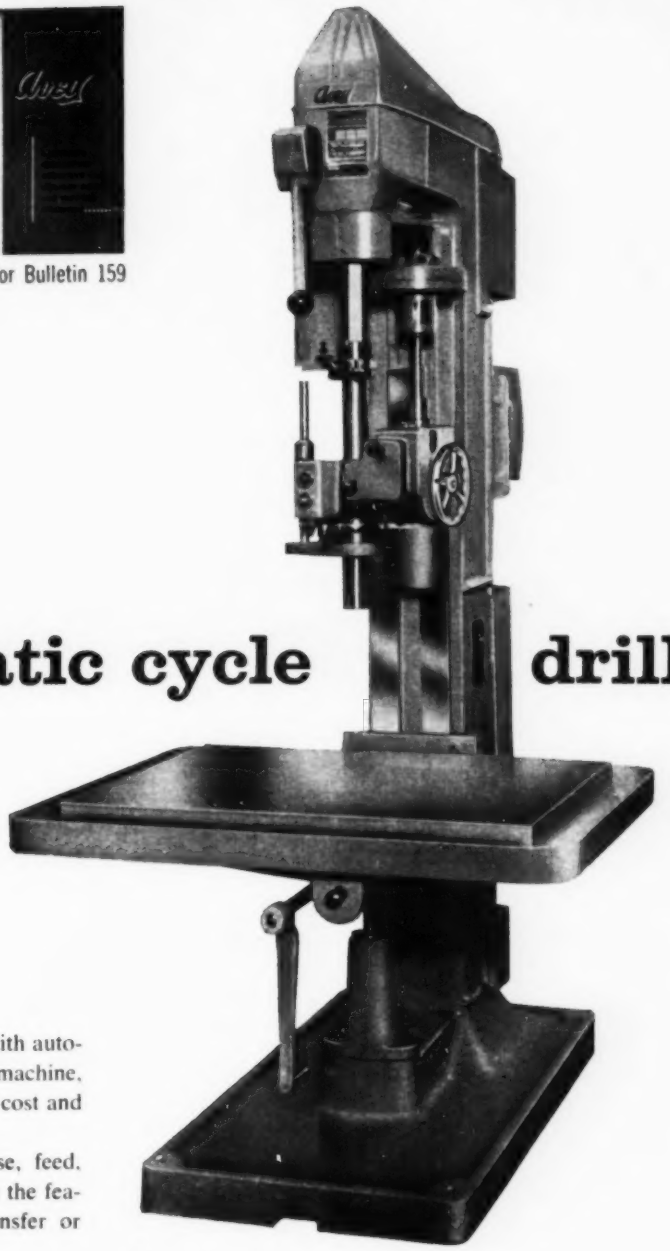
Simplified pendant controls . . .



A Lucas performs the greatest variety of operations possible in any machine tool. Standard models permit control of *all* operations from the pendant. Optional pendant and lever control machines, like the one shown above, combine a simplified pendant with readily accessible levers. Whichever type of control you want—pendant, lever, tape, tracer or any of these in combination—Lucas has it.

LUCAS
OF CLEVELAND

Write for Bulletin 159



automatic cycle drilling

■ You can chop your time costs with automatic set-ups on this new Avey machine, and still take advantage of the low cost and flexibility of a standard unit.

Adjustable rapid power traverse, feed, and rapid return of the spindle are the features which permit automatic transfer or rotary index fixturing.

At the same time, you get adjustable feeds, speeds, table travel, head travel, and Avey's advanced spindle construction.

The machine is available with No. 2, 3, and 4 Morse Taper; 1 to 3 HP motors; single or multiple spindles. Your request for additional information will be promptly answered. Avey Division, The Motch & Merryweather Machinery Co., P. O. Box 1264, Cincinnati 1, Ohio.

Avey

◄ CIRCLE 225 READER SERVICE CARD

CIRCLE 226 READER SERVICE CARD

PARTS BY THE THOUSANDS . . .

Left to right: Plastic tubing, rings and formed spacers, coupling blanks, heavy pipe nipple blanks, standard pipe nipple blanks.

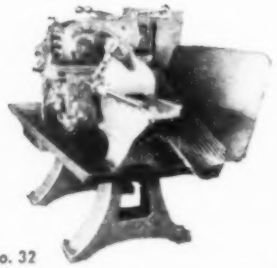
Formed . . . Chamfered . . . Cut-Off on BARDONS & OLIVER Cutting-Off Lathes

Superior Pipe Specialties Co., Chicago, reports a *ten year* profit success using Bardons & Oliver Cutting-Off Lathes.

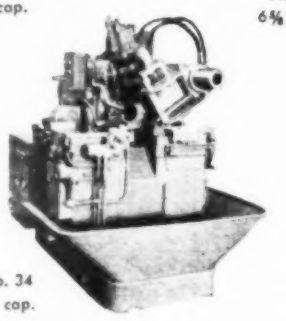
The firm produces parts for their hydraulic equipment plus a wide variety of products on a jobbing basis.

Says Mr. Youhn, Factory Superintendent: "Bardons & Oliver Cutting-Off Lathes are the *only* machines of this type that will stand up under years of hard use. We are completely satisfied with them in every respect."

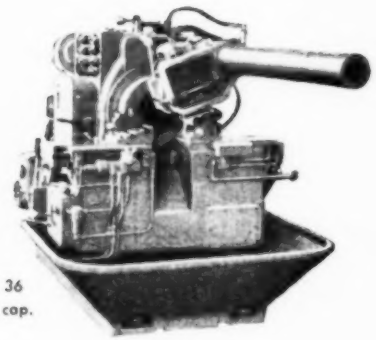
As the above photograph suggests, "versatility" is the name for these Bardons & Olivers. They're unexcelled for forming, chamfering and cutting-off tubular or solid bar stock. You realize extra profits by using these outstandingly rugged machines in your plant. Available in collet capacities from 2 to 16 inches, with automatic loading and unloading equipment if desired.
Bardons & Oliver, Inc., 1133 West 9th Street, Cleveland 13, Ohio.



No. 32
2" cap.



No. 34
4" cap.



No. 36
6⅝" cap.

OPERATING DATA FROM SUPERIOR

Typical hourly production
- No. 32 — 4000 - ½" pipe nipples chamfered & cut-off.
- No. 34 — 1082 - 2" pipe nipples chamfered & cut-off.
- No. 36 — 240 - 5" pipe nipples chamfered & cut-off.

Tolerances held on lengths: ±.002"

Average set-up time: 20 minutes

Tooling
High speed steel, carbide or roller cutter, depending on finish desired, material, operations performed and lot size.

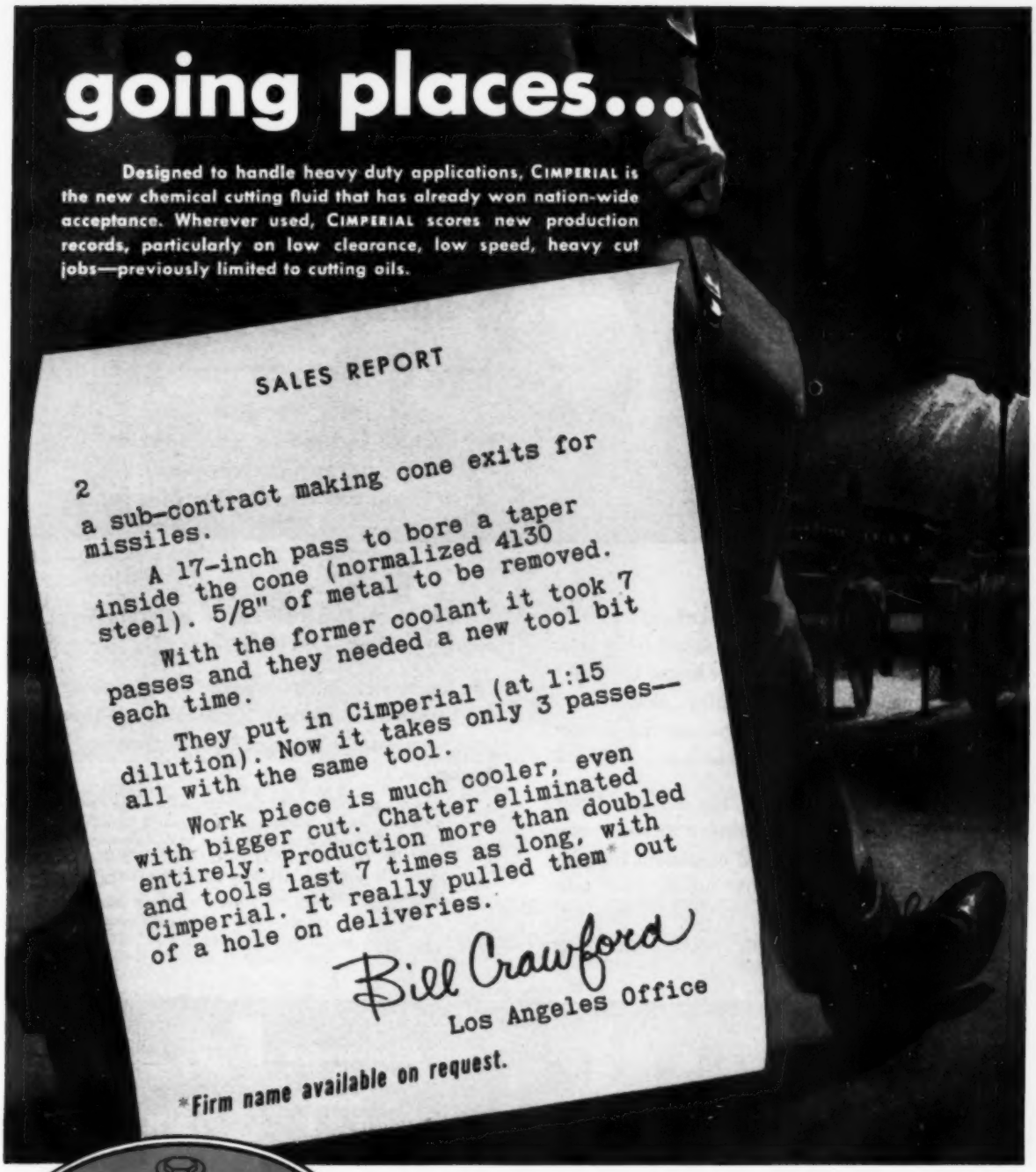
Operators Required
2 men operate 3 machines, including setup, loading, and unloading (With automatic handling equipment 1 man can run 3 machines).

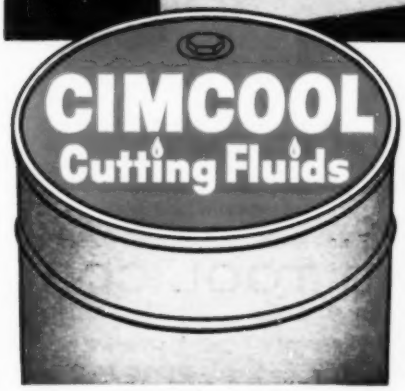
BARDONS & OLIVER

Manufacturers of Turret Lathes and Cutting-Off Lathes

going places...

Designed to handle heavy duty applications, CIMPERIAL is the new chemical cutting fluid that has already won nation-wide acceptance. Wherever used, CIMPERIAL scores new production records, particularly on low clearance, low speed, heavy cut jobs—previously limited to cutting oils.


SALES REPORT
2
a sub-contract making cone exits for missiles.
A 17-inch pass to bore a taper inside the cone (normalized 4130 steel). 5/8" of metal to be removed.
With the former coolant it took 7 passes and they needed a new tool bit each time.
They put in Cimperial (at 1:15 dilution). Now it takes only 3 passes—all with the same tool.
Work piece is much cooler, even with bigger cut. Chatter eliminated entirely. Production more than doubled and tools last 7 times as long, with Cimperial. It really pulled them* out of a hole on deliveries.
Bill Crawford
Los Angeles Office
*Firm name available on request.



FOR 100% OF ALL METAL CUTTING JOBS

Production-proved products of The Cincinnati Milling Machine Co.

CIMPERIAL—newest in the famous, industry-proven line of CIMCOOL® Cutting Fluids!
CIMCOOL S2 Concentrate—The pink fluid which covers 85% of all metal cutting jobs.
CIMPLUS—The transparent grinding fluid which provides exceptional rust control.
CIMCUT Concentrates (AA, NC, SS)—For every job requiring an oil-base cutting fluid.
ALSO—CIMCOOL Tapping Compound—CIMCOOL Bactericide—CIMCOOL Machine Cleaner.

For full information on the complete family of CIMCOOL Cutting Fluids, call your CIMCOOL Distributor. Or contact Cincinnati Milling Products Division, Cincinnati 9, Ohio.

®Trade Mark Reg. U.S. Pat. Off.

◄ CIRCLE 227 READER SERVICE CARD

CIRCLE 228 READER SERVICE CARD

This was our biggest production bottleneck ...until we got Spiral Points*

says Jack Anderson, Chief Industrial Engineer at Lunkenheimer Company, Cincinnati valve manufacturer.

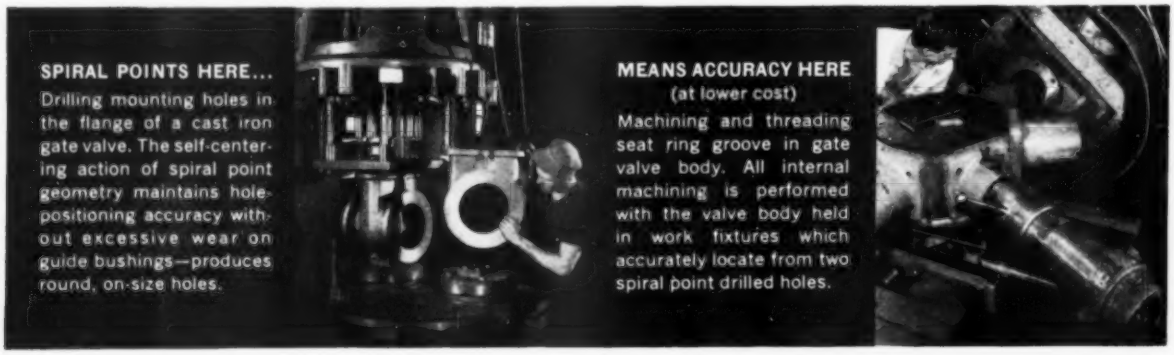
"Just two of these holes are critical—all other machining operations are located from them. But it used to cost us plenty to get them right —frequent drill resharpening, slower feeds, touching up the holes, even special locating pins and eccentric guide bushings.

"It sounds like a miracle, but our spiral point drills broke this production bottleneck completely! They maintained consistent hole size, well within our plus .005" minus .004" tolerance. They don't walk, so guide bushing wear has been practically eliminated. And, where we used to get 225 to 250 parts per drill grind, we now average 2000 or better.

"In short, they drill holes where we want them, to the size we want them . . . in one pass. Now production stays on schedule . . . scrap is negligible."

**Spiral point is Cincinnati's new drill point geometry which transforms a standard twist drill into a cost-reducing, precision tool. Cincinnati's SPIROPOINT® DRILL SHARPENER automatically applies this new point geometry in a matter of seconds.*

ASK YOUR CINCINNATI LATHE AND TOOL CO. DEALER, OR WRITE TO US DIRECT.


SPIRAL POINTS HERE...
Drilling mounting holes in the flange of a cast iron gate valve. The self-centering action of spiral point geometry maintains hole-positioning accuracy without excessive wear on guide bushings—produces round, on-size holes.
MEANS ACCURACY HERE
(at lower cost)
Machining and threading seat ring groove in gate valve body. All internal machining is performed with the valve body held in work fixtures which accurately locate from two spiral point drilled holes.

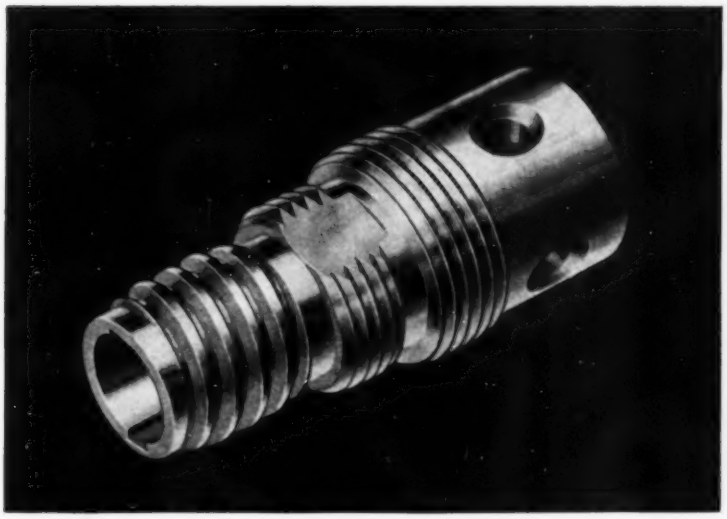
Improved Machining Through Research

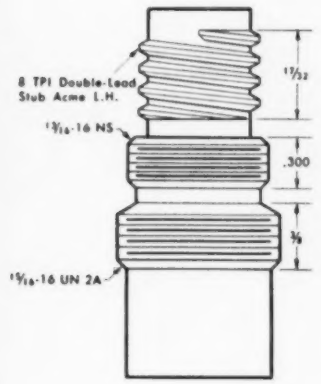
CINCINNATI LATHE AND TOOL CO.

3207 Disney Street • Cincinnati 9, Ohio

"TRAY-TOP" Lathes / "CINCINNATI" Drilling Machines / "SPIROPOINT" Drill Sharpeners

COST CUTTING on tough jobs—like rolling a double-lead Stub Acme thread—may be easier than you think. Olson Mfg. Co. needed only a minor adjustment in a standard Anaconda rod

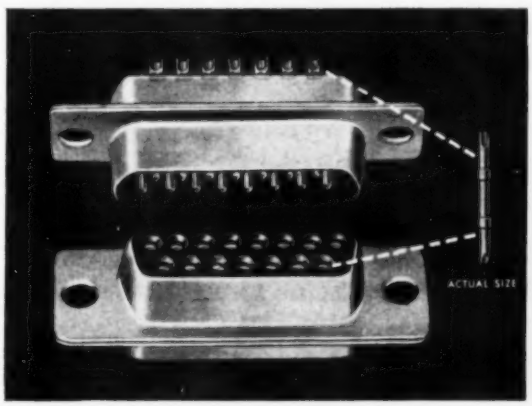




Rolling three threads *(drawing, right)* in two positions on a 6-spindle automatic meant cost savings for Olson Mfg. Co., Worcester, Mass. The Acme thread, however, posed problems. American Brass specialists suggested minor modification of standard Anaconda Free-Cutting Brass Rod to provide the extra ductility needed. The idea worked and the resulting valve spindle is shown above, about 1½ times actual size.

—or maybe you need a different alloy rod. The tiny connectors, right, have to be machined from .078" rod, requiring many precision form-cutting, drilling, slotting operations. So machinability is a vital property of the rod used—but so are adequate electrical conductivity, high strength, and fatigue resistance.

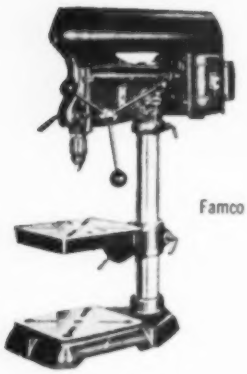
Cannon Electric, Los Angeles, makers of these electrical plug assemblies, had to find a rod with a delicately balanced combination of mechanical properties to provide the unfailing and continuous performance required. They found it in Anaconda Free-Cutting Phosphor Bronze-610 Rod, developed by American Brass metallurgists to combine the strength, resilience, fatigue resistance of phosphor bronze, and machinability approaching that of free-cutting brass.



MEETING the joint requirements of designers, manufacturing men, and buyers—to achieve high quality and performance while simplifying fabrication and cutting over-all costs—is an important function of American Brass technical specialists. For imaginative and practical help of this kind, see your American Brass Company representative or write: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

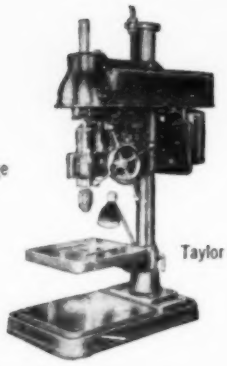
ANACONDA®

COPPER · BRASS · BRONZE
NICKEL SILVER · MILL PRODUCTS
Made by The American Brass Company


Famco

Walker-Turner

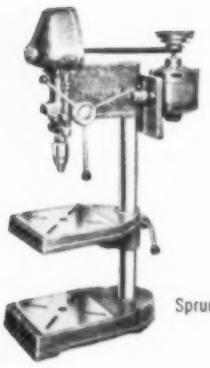
Buffalo Forge


Taylor

Duro

DRILL PRESS MANUFACTURERS

put their money on

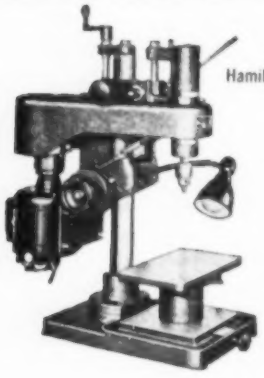

Sprunger

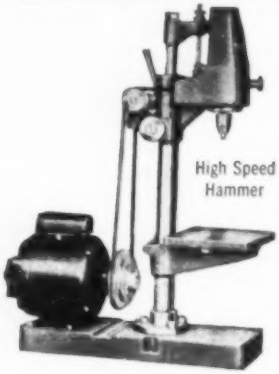
Delta

Powermatic

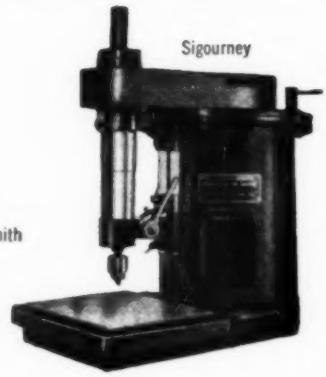
South Bend

Sears' Craftsman

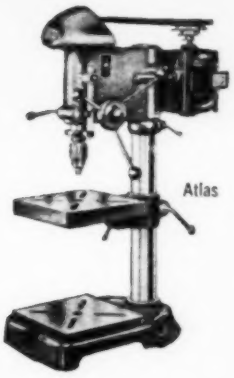

Hamilton


High Speed Hammer

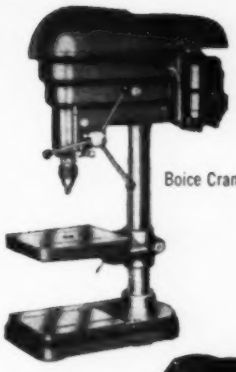
Shop Smith


Sigourney

CIRCLE 231 READER SERVICE CARD


Atlas

Avey


Boice Crane

Ward's Powr-Kraft

Champion

Jacobs

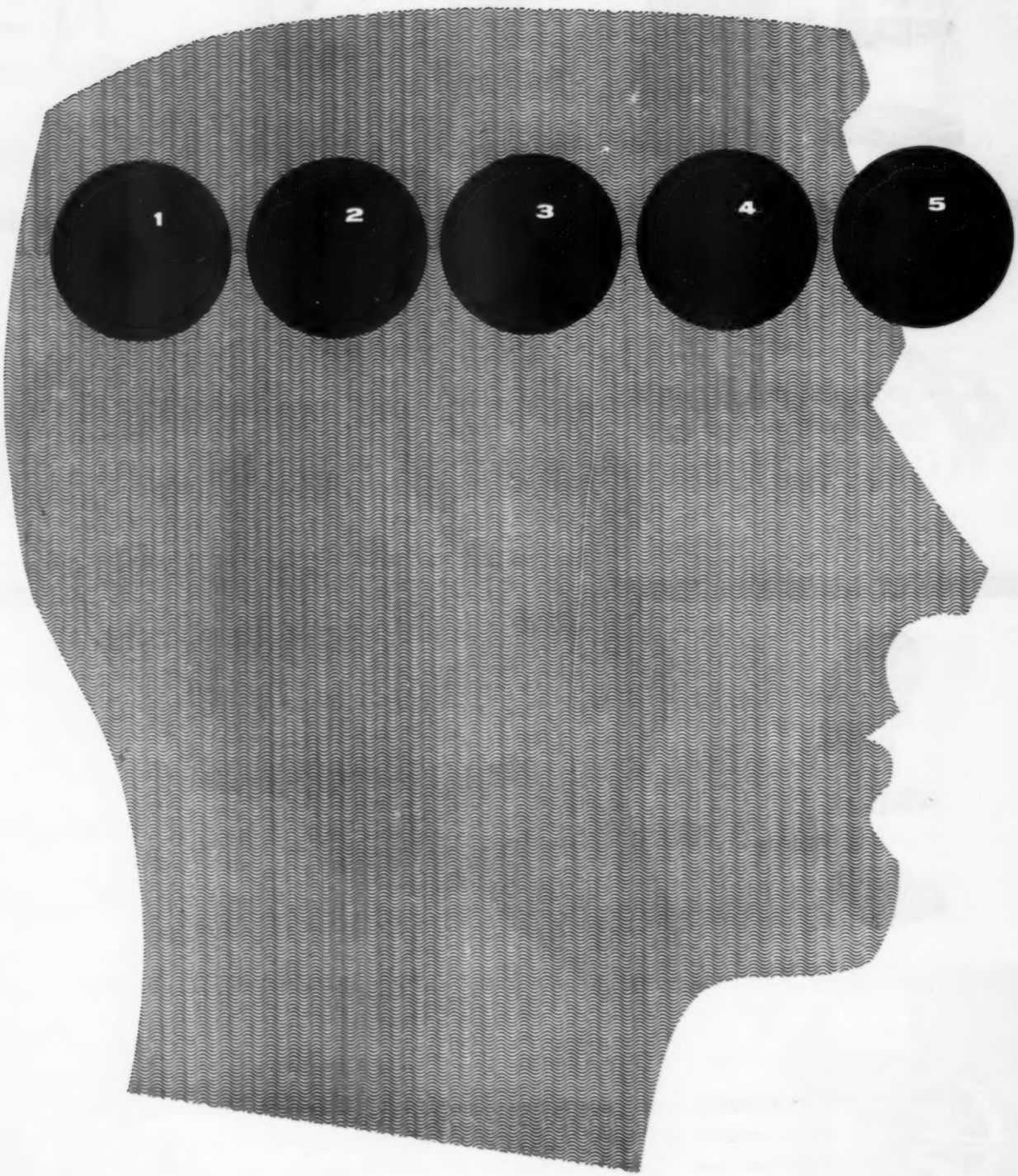
Darra James

A PARTNERSHIP IN PROGRESS

Your industrial supply distributor makes it his business to know your business. He is always available and ready to fill your needs quickly, dependably and economically. When you need chucks, you can depend upon Jacobs and the Jacobs industrial supply distributor who works with you . . . your partner in progress through service.

THE JACOBS MANUFACTURING COMPANY, WEST HARTFORD, CONNECTICUT

CIRCLE 232 READER SERVICE CARD



CIRCLE 230 READER SERVICE CARD

count to ten . . .

and then

scream

That shipment of high temperature alloys hits your receiving dock. Everything goes great. No production headaches. No kicks from the field. Your wife looks several years younger and the dog doesn't growl at you any more.

You reorder from the same company. Still no problems . . . except you can't stop smiling while you shave. All told, you get nine separate shipments from this source. You're beginning to think high temperature alloy problems are the fantasies of fools.

So you place order number ten. Same supplier. Same grade. Same everything . . . except *this* lot fails to get by the eagle eye of your inspector. You've got a real procurement problem. Schedules suffer. Now your wife looks twenty years older and the dog snaps at your heels and you would trade your favorite putter for a high temperature alloy you can count on.

Carpenter hasn't come up with a cure for all your woes, but we have perfected a revolutionary new steelmaking process which minimizes variations from lot to lot. Called the MEL-TROL® process, it features a patented mold which reduces segregation of harmful impurities during solidification of the ingot. Result: you get clean, sound, tough metal from surface to centerline . . . in every bar . . . every time you order.

Now predictable performance is yours for the asking.

tool and die steels
stainless steels
electronic, magnetic and electrical alloys
high temperature alloys
special-purpose steels
tubing and pipe
fine wire specialties

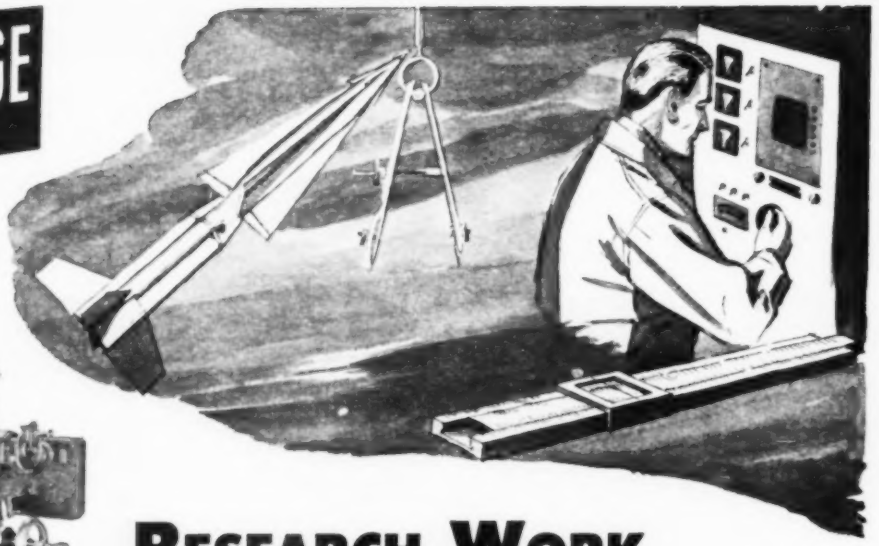
***Carpenter* steel**

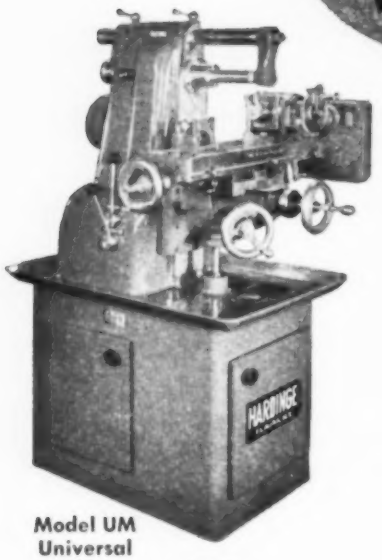
a new company 70 years old

The Carpenter Steel Company, Main Office and Mills, Reading, Pa.
Alloy Tube Division, Union, N. J.
Webb Wire Division, New Brunswick, N. J.
Carpenter Steel of New England, Inc., Bridgeport, Conn.

CIRCLE 234 READER SERVICE CARD

HARDINGE
ELMIRA, N.Y.



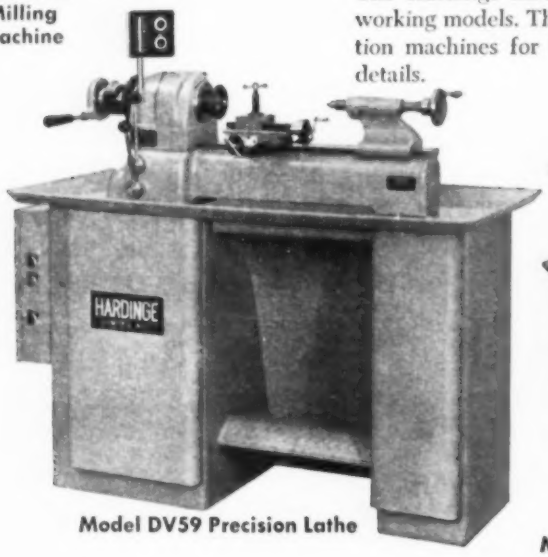


Model UM Universal Milling Machine

RESEARCH WORK
Demands
THE BEST IN MACHINE TOOLS

HARDINGE is the only manufacturer of companion precision machines for milling, straight turning, taper turning, boring, threading and facing with the feature of interchangeable collets, nose fixtures and attachments.

The Hardinge machines illustrated produce precision parts for working models. There are also three Hardinge precision production machines for high speed volume manufacturing – ask for details.



Model DV59 Precision Lathe

Model HLV High Speed Tool Room Lathe

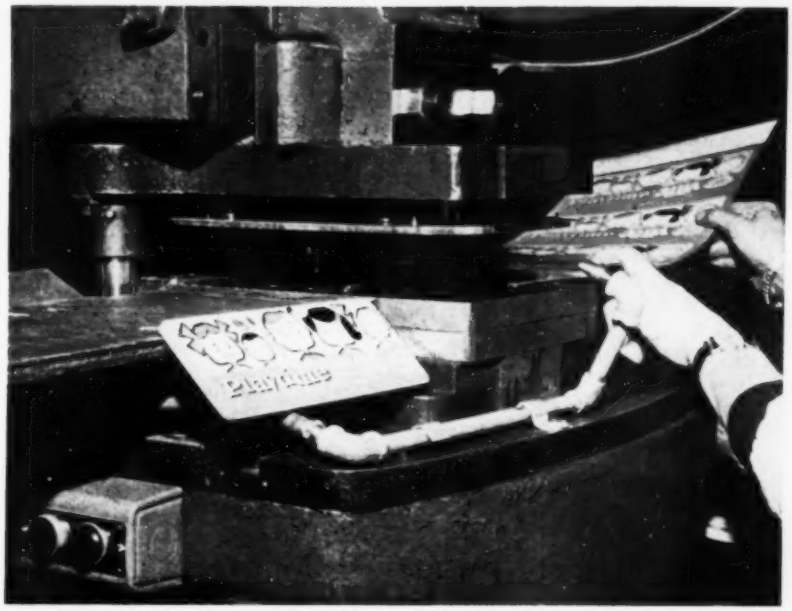
SPECIFICATIONS: *The UM Universal Milling Machine has cutter spindle and spiral dividing head collet capacity of 1-1/16" and a 25 x 6-1/2" swivel table. The DV59 Precision Lathe has 1-1/16" capacity and 9" swing with 17" between centers distance. The HLV Tool Room Lathe has 1-1/16" capacity and 11" swing with 18" between centers distance.*

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

Tool Steel Topics

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.



Lehigh H Teams Up with Brake Die

Result: 150,000 Box Tops

The job was a tricky one. It called for the blanking and forming of .010-in. black plate into hinged tops for children's paint boxes. But with the black plate already lithographed, it was imperative to avoid marring the material.

The manufacturer, Sobel Metal Products Co., Easton, Pa., talked it over with his local Bethlehem tool steel distributor, Luria Steel Supply Co., Catasauqua, Pa. The Luria representative proposed the use of Lehigh H for the die, and Brake Die for the punch. This proved a wise choice, for combined, the two tool steel grades turned out 150,000 pieces without any need for redressing. And the black plate received nary a scratch.

Bethlehem Lehigh H (AISI D-2) is our easy machining high-carbon, high-chrome tool steel. It is an air-hardening grade, with plenty of wear-resistance thanks to its excellent carbide distribution. Brake Die, a grade of special analysis steel, is oil quenched and tempered to develop the mechanical properties needed for maximum wear and toughness.

Bethlehem regularly produces about 30 different grades of tool steel—a range so wide as to meet virtually every requirement. For full information, call your Bethlehem tool steel distributor.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

Hot-Work Tools Last Longer When Thermal Stress Is Reduced

Deterioration of hot-work tools in service by heat checking or cracking depends largely on the severity of thermal stress developed in service. Anything which can be done to decrease the magnitude of the thermal stress will increase the service life of the tools.

One of the most essential steps in using hot-work tools is to preheat them to their normal working temperature before use. This seemingly insignificant step will often improve the tool life appreciably because it decreases the severity of the initial stress cycles.

The provision of multiple tools which are used in succession is another simple way to decrease thermal stresses on certain types of hot-work tools. For example, on piercing operations the press may be provided with as many as six piercing punches mounted on an indexing fixture. After each piercing operation a different punch is moved into position for the next operation. This permits each punch to cool during the time of the next five operations, greatly reducing the severity of thermal stress. The service life of punches used in this manner is often twice that of punches used continuously in the same operation.

Air-4 hardens in air at 1550F.

With AIR-4 You Get Air-Hardening at Low Temperatures . . . FREE MACHINING . . . EXCELLENT WEAR

Air-4, Bethlehem's new medium-alloy tool steel, hardens in air at 1550F, and has excellent free-machining properties due to its carefully controlled addition of lead. It has exceptional wear-resistance and high toughness. Moreover, it can be heat-treated with complete freedom from the dangers of cracking. Ask your Bethlehem tool steel distributor for complete information on Air-4.

du MONT TOOL BITS can TAKE it because they're BALANCED in

—TOUGHNESS
—RED HARDNESS
—WEAR RESISTANCE

An almost perfect balance of these three important qualities enable duMont High Speed Tool Bits to take a keener cutting edge and hold it longer — to give you a bonus of cutting life in every bit.

Make your own tests — compare cost and performance. See why economy-minded buyers everywhere favor duMont H.S. Tool Bits.

MAIL TODAY SAVE TOMORROW

The du MONT CORPORATION, Greenfield, Mass.

MAIL FREE Tool Bit COMPARISON CHART, CATALOG and PRICE LIST A.

Name.....

Company.....

Address.....

Letters...

To American Machinist
330 W 42nd St, NY 36, NY

Russian catalog

Dear Sirs:
We wish to make reference to your "Machine Tool" page (*AM*—June 29 '59, p69), which states that Stankoimport, the Russian selling agency, is offering a 109-page catalog in English of Soviet products for export.

We shall appreciate it if you send us this catalog, because we believe it would be very interesting.

Segismundo Pons
Havana, Cuba

Dear Sirs:
Please advise us where we may secure the proper address to request the Stankoimport Russian catalog referred to in. . .

C W Buyers
Sterling, Ill

Requests for the catalog should be sent to Smolenskaja-Sennaja Pl. 32/34, Moscow, USSR—Ed.

EDM disagreement

Dear Sirs:
Concerning the evaluation chart of capabilities as compiled by Sam Ratmansky for your article on Russian electrical-discharge machining (*AM*—July 27 '59, p92), we are enclosing the performance data for the Elox NPS-100 power supply.

We are presuming that this data would be immediately forwarded to all who requested the initial, inaccurate chart and that the magazine might take immediate steps to publish some type of retraction in a subsequent issue. As the leading periodical in its field and as the pioneer reporters of electrical-discharge machining processes, we know that your fullest cooperation can be expected.

Thomas G Larkins, *sales manager*
Elox Corp of Mich
Troy, Mich

The evaluation chart referred to was prepared by Mr Samuel C Ratmansky for International Resistance Corp, Philadelphia. It compared the Russian Impulse Generator machine recently exhibited in New York, the Elox PS 50, and the Matson PS 100. The Elox NPS-100 is a newly available power supply using fewer tubes, yet with higher output *(see page 167).*

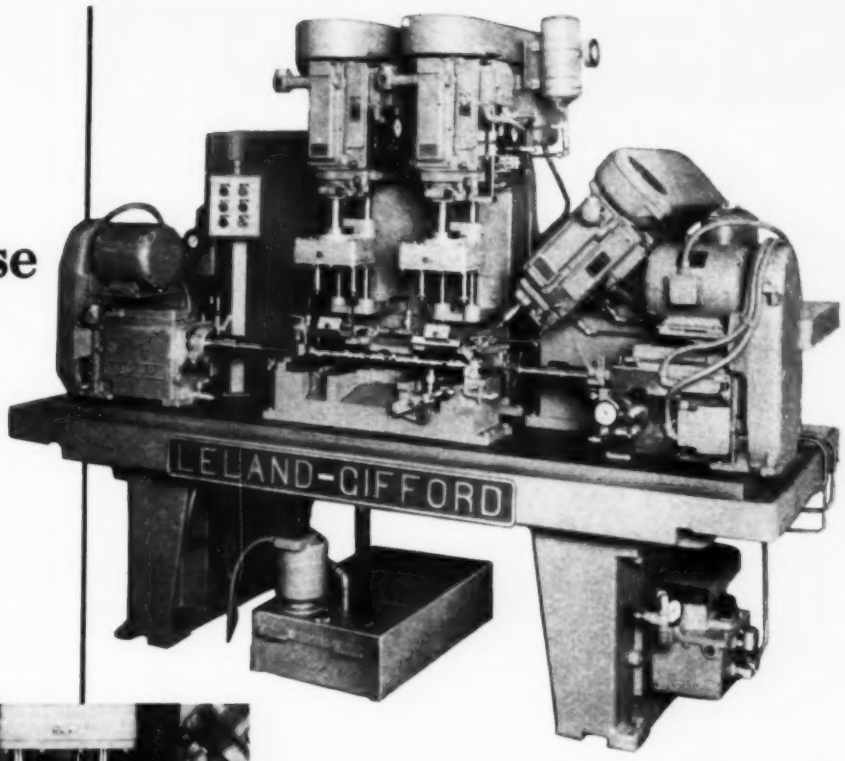
The Elox Corp disagreed with

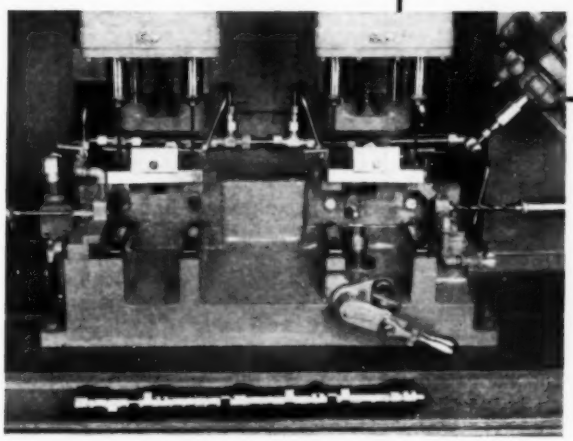
SHOPMATES

N. Jarvis

HEY! YOUNG FELLER!! LOOK HERE! YOU AIN'T SUPPOSED T' PUT NOTHIN' IN HERE BUT STUFF THAT'LL BURN!
OH NO!! I JUST GOT RID OF SOME STUFF I SPOILED... I HID IT IN THE WHIPS WASTE BASKET!
USE MOT HOOKS
FRAGILE
N. JARVIS

Here's an idea you can use to cut precision drilling costs . . . .





One machine, one handling, one quick, simple operation does all the precision drilling on this camshaft. Note that this is not ordinary gang drilling — the job involves axial, angular and cross holes as well as reaming.

Leland-Gifford has time-saving, cost-cutting ideas for you, too — ways you can combine multiple operations into a simple, efficient unit operation.

THE JOB: Drill one end of camshaft and ream the other while drilling four cross holes and one angular oil hole.

THE MACHINE: A Leland-Gifford special with five No. 2 self-contained units and standard hydraulically clamped fixture interlocked with drilling units to start feed after clamping and to unclamp when operation is finished. SC units are interlocked to prevent interference between cross and axial drills. One operator completes 60 camshafts per hour at 100% efficiency.

For Automatic Drilling at its best be sure to see Leland-Gifford

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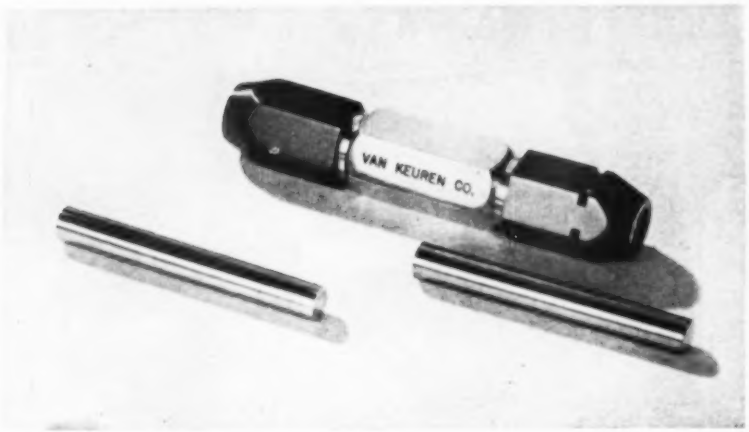
IMMEDIATE DELIVERY

Van Keuren WIRE TYPE PLUG GAGES



WIRE TYPE (REVERSIBLE) PLUG GAGES were originated by **THE VAN KEUREN CO.** in 1923, and since that time have been supplied to an ever expanding group of manufacturing concerns throughout the country and abroad. The wire type design has enjoyed tremendous popularity because of the inherent economy represented by the fact that the gage units can be reversed, or cut off, to obtain substantial increase in gage life.

As a result of our long experience in developing and pioneering the manufacture of wire type plug gages and the sale of millions of these units, we have come to know what sizes will be required during a given period of time, and have prepared ourselves by finishing in advance a multitude of units which are in constant readiness for shipment. Our methods of size prediction through research and sales analysis have been successful to the point that there is now better than a four out of five chance that at any time we will have on hand the gage or gages that you need. In addition improved and highly efficient methods of manufacture developed during the years of our work in this field make possible the manufacture, to your requirement, of any size not on hand, in an incredibly short time.

VAN KEUREN WIRE TYPE PLUG GAGES are made to the most exacting requirements as to diameter, roundness, hardness, stability and surface finish. They are offered in all tolerances from XXX (.00001") to ZZ, and are available as units, in handles, or in sets.

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THE Van Keuren CO.
Since 1920
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PRECISION MEASURING TOOLS
. . . rated the world's most accurate
Plug Gages · Measuring Wires · Optical Flats and Light Wave Equipment · Gage Blocks · Precision Lapping Service and Parts

some of Mr Ratmansky's figures on the PS 50. The data prepared by Robert Webb, director of research at Elox, on both models has been sent to all readers who requested the original chart. Single copies of the data on these machines are available on request to Readers Service Department, American Machinist, 330 W 42nd St, New York 36, NY.

The data prepared by Mr Ratmansky on the PS 50 varies slightly at several points from that supplied by Mr Webb. It varies most significantly on the suggested electrode, the methods of making electrodes, and the electrode wear in steel. These are reported by Elox as sheet metal, graphite, zinc alloys, and sprayed metal as materials; casting, spraying, and sheet metal as methods; and 100 to 1 as the rate of electrode wear in steel when done the right way. Mr. Webb said that it should be possible to achieve such a rate of electrode wear in about 30% of the cavity applications.—Ed.

Dear Sirs:

Your article on electrical-discharge machining is certainly a masterpiece of technical information, far above the usual so-called technical articles.

So often articles of this type are written from a point of view that says, "It's better, because it's better, because it's better . . ." It's refreshing to have an experienced analyst look at what the machine can do.

Fritz Fiesselmann, *vice pres*
Production Machy Sales Co, Inc
Detroit, Mich

"Stebbins, I'm not firing you, but I am assigning you to our branch on Mars—when it opens."

CALENDAR

American Welding Society—National Fall Meeting, Sept 28-Oct 1, Sheraton-Cadillac Hotel, Detroit, Mich.

Society of Automotive Engineers—National Aeronautic Meeting and Display, Oct 5-10, Ambassador Hotel, Los Angeles, Calif.

American Society of Tool Engineers — Semi-annual Meeting, Oct 8-10, Chase-Park Plaza Hotel, St Louis, Mo.

American Society for Testing Materials—Pacific Area National Meeting, Oct 11-16, Sheraton Palace Hotel, San Francisco, Calif.

Society of Plastics Engineers—National Technical Conference, Oct 13-14, Ambassador Hotel, Los Angeles, Calif.

Magnesium Association—Annual Convention, Oct 19-20, Hotel Roosevelt, New York, NY.

American Institute of Electrical Engineers—Machine Tool Conference, Oct 19-21, Sheraton-Cleveland Hotel, Cleveland, Ohio.

National Safety Council—National Safety Congress, Oct 19-23, Chicago, Ill.

American Machine Tool Distributors Association — Annual Meeting, Oct 25-27, Statler Hotel, St Louis, Mo.

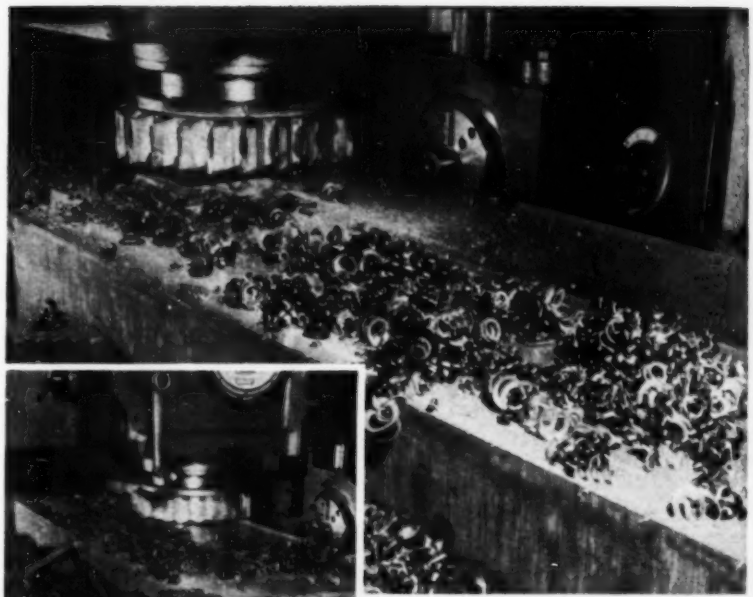
American Gear Manufacturers Association—Semi-Annual Meeting, Oct 25-28, Edgewater Beach Hotel, Chicago, Ill.

American Society for Metals—National Metal Exposition and Congress, Nov 2-6, International Amphitheater, Chicago, Ill.

National Tool & Die Manufacturers Association — Annual Convention, Nov 4-8, Statler-Hilton Hotel, New York, NY.

Industrial Management Society—Industrial Engineering and Management Clinic, Nov 5-6, Conrad Hilton Hotel, Chicago, Ill.

National Screw Machine Products Association — Fall Membership Meeting, Nov 14-18, Americana Hotel, Bal Harbor, Fla.



1/16" finish cut. Note fine surface finish, a result of true running, flywheel cutting action.

Cutter at completion of roughing cut. 1/2" stock removal. Note efficient, uniform chip formation.

1/2" STOCK REMOVAL on part of MISSILE LAUNCHING PAD AT ONE PASS!

. . . Another Outstanding NELCO Carbide Tipped Tooling Application

And that's not all . . . the 1/2" roughing cut at 14" per minute feed and the 1/16" finishing cut at 20" per minute feed were made with the *same "standard" off-the-shelf cutter.* The operations are performed on a 50 H.P. Gray Planer Mill, the tool is a NELCO 12" face mill for steel.

This versatile cutter has extremely heavy brazed carbide tips to withstand shock and interrupted cuts. Exceptional cutter weight gives flywheel effect and insures superior heavy stock removal and extremely fine surface finishes.

Send for Cutting Tool "Condensalog" with prices on 3300 "Standard" profit improving cutters to: *Cutting Tool Division, Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.*

Brown & Sharpe

CUTTING TOOL DIVISION

HIGH SPEED STEEL CUTTERS

NELCO CARBIDE TOOLS

END MILLS

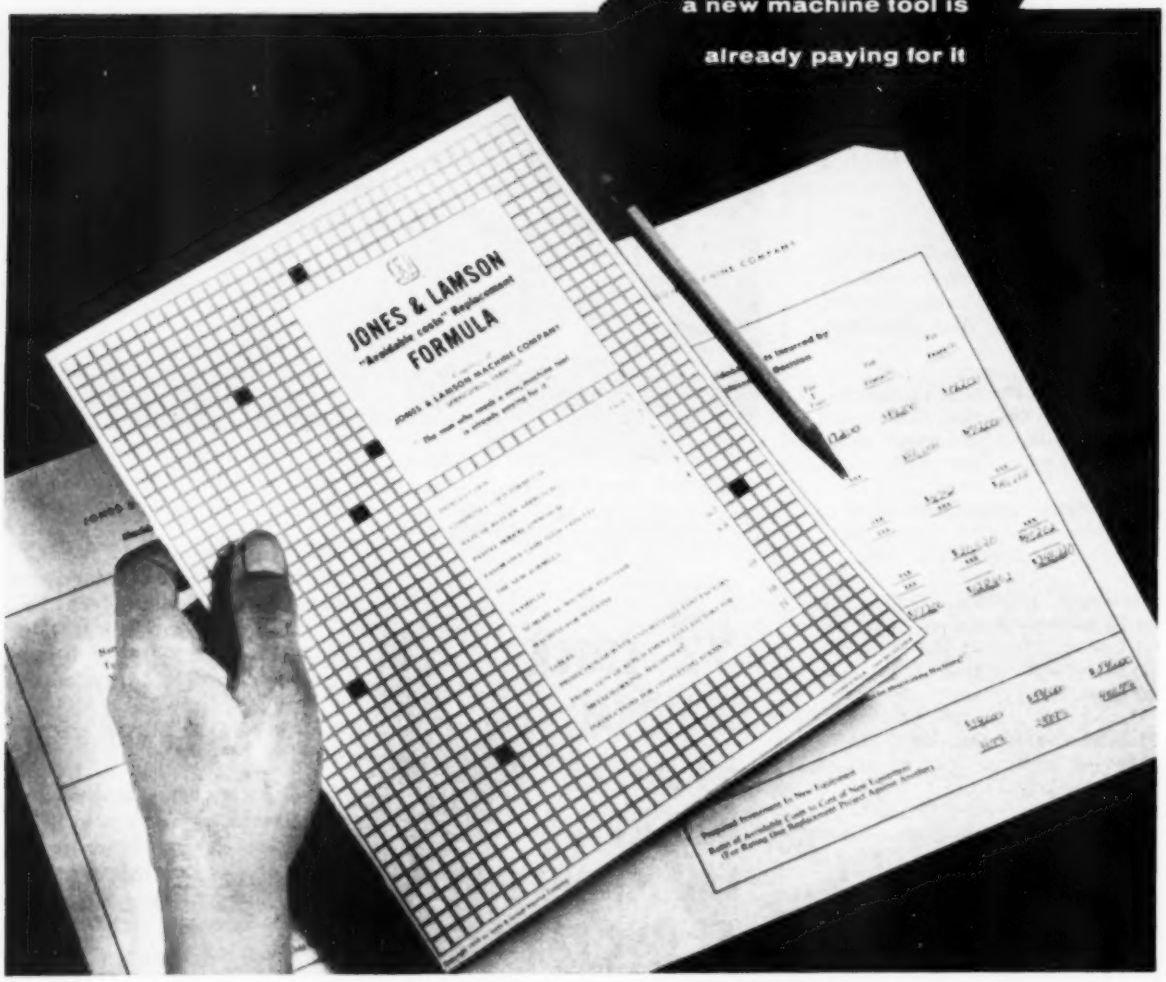
B·S

FOR THAT EXTRA EDGE IN PRODUCTION

INDUSTRIAL DISTRIBUTORS — THE RIGHT HAND OF PRODUCTION

JONES & LAMSON MACHINE COMPANY

the man who needs a new machine tool is already paying for it



How to get Equipment Dollars from Management

To management men, nothing speaks so eloquently as facts. Take the men in *your* front office, for instance. When told that a new machine tool (or several new ones) is a "must", they may very well be inclined to agree. But they have to be *shown*.

In order to sell management, you must present an accurate, factual statement, comparing current productivity of existing equipment, with the productivity attainable with new, advanced equipment.

And this is where you must exercise extreme caution.

Why?

Because, practically without exception, the formulas commonly used for evaluating machine tool performance contain flaws, fallacies and limitations which are seriously misleading. They give an erroneous picture because they distort the facts.

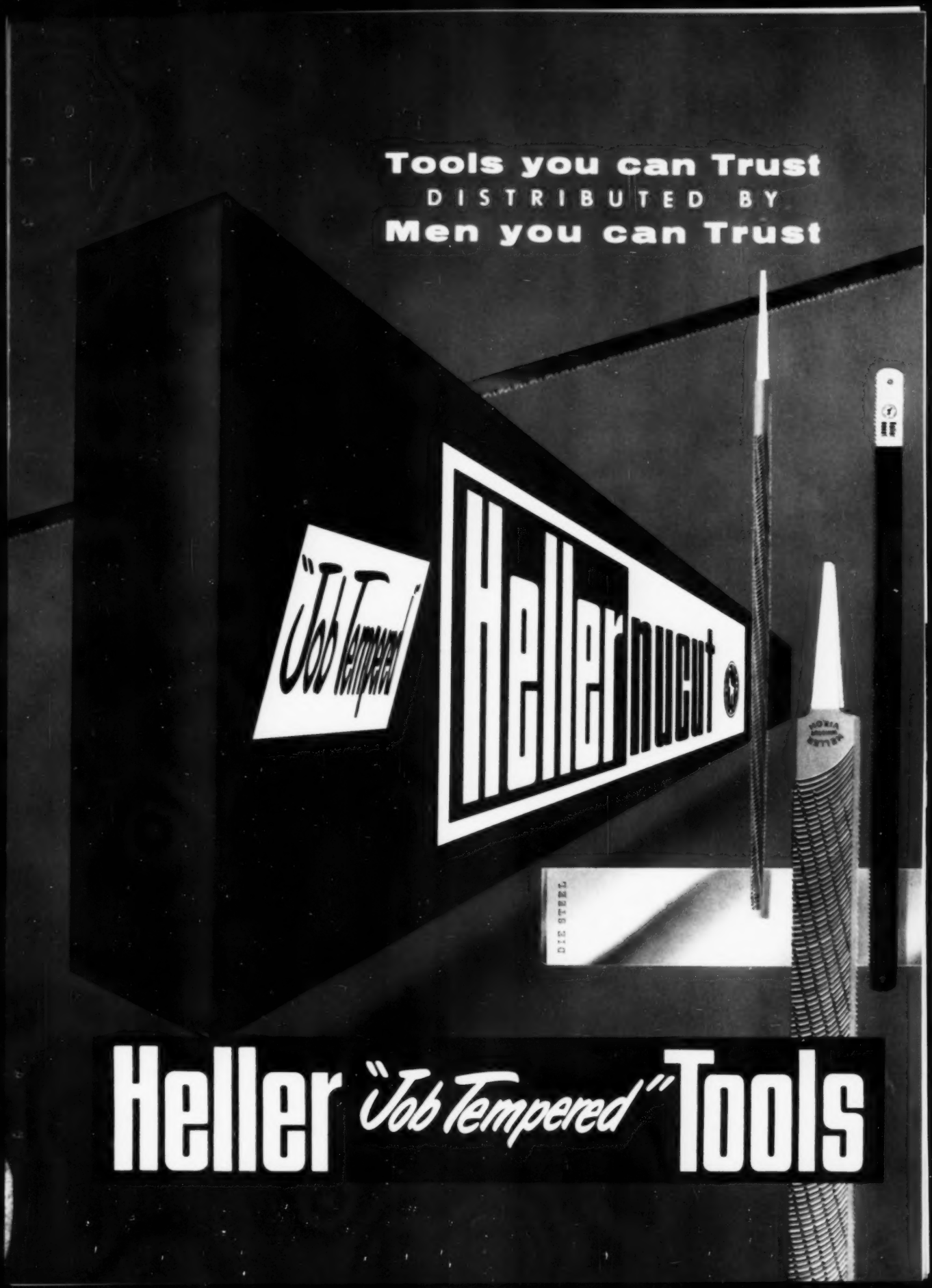
Happily, J & L has the answer to this problem. It's the new J & L "Avoidable Costs" Replacement Formula, which gives you an easy, step-by-step method of productivity evaluation which is logical, accurate and reliable. This formula is tried and true. It gives you a clear, true picture and supplies you with the facts you need in order to get that new machine you're looking for.

For your copy of J & L's "Avoidable Costs" Replacement Formula, together with easy-to-use work sheets, write Jones & Lamson Machine Company, 502 Clinton Street, Springfield, Vermont.

Turret Lathes • Automatic Lathes • Tape Controlled Machines • Thread & Form Grinders • Optical Comparators • Thread Tools

CIRCLE 241 READER SERVICE CARD

CIRCLE 242 READER SERVICE CARD ►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TO LOWER COSTS

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Flat Ground Steel

Avoid costly machining-to-size and finishing operations with ready-to-scribe Heller Flat Ground Steel. Smooth finished to 25-35 micro inches and free from scale, decarbonization and surface defects, they are stocked in a wide range of over 1500 accurately dimensioned flats and squares.

HELLER FLAT GROUND DIE STEEL* is your best source of wear-resistant DIES, PUNCHES, PATTERNS AND PARTS. Available in *oil hardening* and *air hardening* types, it is spheroidize annealed for easy machining and uniform hardening. So, it cuts unit costs to profitable levels.

HELLER FLAT GROUND LOW CARBON STEEL meets demand for parts that require no heat treating or just case hardening. Made of fine-grained, silicon killed, forging quality steel, it is easy to machine and weld.

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SPOT NEWS...

- **Top attraction at the Sixth European Machine Tool Exhibition in Paris** is a numerically controlled machine (similar in principle to a K & T Milwaukeematic), which is equipped with an automatic vertical tool changing unit developed by GSP of France. It's reported to be priced around $50,000. On display at Paris are about 3500 machine tools, total weight 12,000 tons. Show has 1001 exhibitors, including 342 French and 332 German. Probably 20 to 25% of exhibitors are manufacturers of welding machines, machine tool accessories, and products other than machine tools. On display are many machines equipped for automatic loading and unloading. Many are numerically controlled.

- **Automobile inventories figure to be about 300,000 units** as cars go into the new model year—a number that won't be too tough to sell. According to one automaker, "Any year we've had trouble we've walked into a new model year with 500,000 or more cars in inventory. This year, if sales hold up the way they have been, we won't have that kind of trouble."

- **Russians have just come up with two new "firsts":** (1) a fully automatic remotely controlled lathe that machines aluminum pieces up to 3.2 in. in diameter and to 6.5 feet long in from 7 to 12 minutes, depending upon the difficulty of the desired shape, and (2) a forging press frame electroslag welded into a single unit from nine different rolled plates and cast components in just eight hours. Welding seam is 54.6 in. thick and 314.8 in. long.

- **Argentina has just lifted a 40% surcharge on industrial machinery imports** and on road construction equipment.

- **Government has leased its Richmond, Calif, Reserve Shipyard** to Willamette Iron & Steel Co of Portland, Ore, for $200,000 a year, plus a rental fee for all machine tools used by the lessee.

- **Suit brought against four major West Coast steel producers** by Independent Iron Works Inc, Oakland, Calif, has been thrown out on grounds that five weeks of hearings failed to produce proof of conspiracy to limit supplies of steel to small companies during the 1955 steel shortages. Independent Iron Works charged that the steel producers did this by channeling steel to their own subsidiary fabricating plants.

- **Milling cutter of copper-impregnated powdered iron** with locked-in ceramics is said to outlast any other cutter 12 to 1. Developed by Spring Garden Institute, the new cutter is designed to solve difficult machining of high alloy stainless components for a 2500-mph U S military plane. Also claimed for the cutter: less vibration, smoother finish.

- **Total 1958 shipments of machine tools** (based on just released Commerce Dept figures involving 542 companies) amounted to $655 million. Of this total, metalcutting machine tools accounted for $455 million, a drop of 48% from 1957. Metalforming machine tool shipments dropped 50% from 1957 totals to around $200 million. Even if steel shortages grow crucial, the industry will show a spectacular improvement this year (see p103).

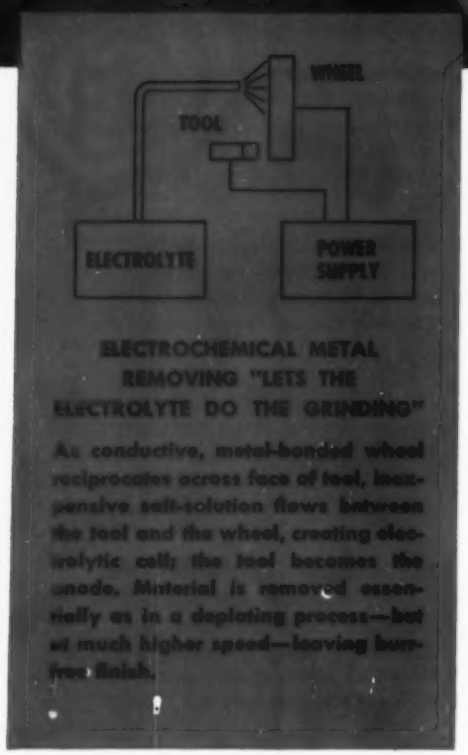
- **Two of Detroit's Big Three** automakers are said to be interested in the work of Nitroform Inc, Birmainham, Mich, in development of experimental and prototype auto parts by explosive forming. Already under development: metallic gaskets, housings and bezels for lights and similar parts. To come: large parts such as deck lids, roof panels, bottom pans and hoods—all of which could be explosive-formed cheaply and accurately without need for extensive tooling.

NEW

Reciprocating Electrolytic Tool Grinder

MICRO-FINISHES CARBIDES, CUTS DIAMOND-WHEEL WEAR 80%

59-25



ELECTROCHEMICAL METAL REMOVING "LETS THE ELECTROLYTE DO THE GRINDING"

As conductive, metal-bonded wheel reciprocates across face of tool, inexpensive salt-solution flows between the tool and the wheel, creating electrolytic cell; the tool becomes the anode. Material is removed essentially as in a depleting process—but at much higher speed—leaving burr-free finish.

Because its reciprocating wheel just "wipes away" the carbide particles, Ex-Cell-O's Style 264 Electrolytic Tool Grinder reduces diamond wheel consumption by as much as 80 per cent! With one set-up, tools can be precision-finished to better than 15 micro-inches—free from heat checks, cracks or burns caused by abrasive contact.

The Style 264 grinds the cutting edges of carbides and other super-hard tool materials at one end, grinds chip breakers at the other. Wheel stroke is fully adjustable. Standard equipment includes: Ex-Cell-O Precision Spindle with inbuilt reversible motor, universal chip breaker fixture (shown in circled inset, above), and pressure system for electrolyte.

Write direct, or see your Ex-Cell-O Representative for details on the Style 264, conventional Style 142 Reciprocating Tool Grinder, and others in the complete Ex-Cell-O line.

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN

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Machinery Division

EX-CELL-O PRECISION PRODUCTS INCLUDE: MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • TORQUE ACTUATORS • THREAD AND GROOVE GAGES • GRANITE SURFACE PLATES • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

WASHINGTON...

Capital spending boom...

A new capital plant and equipment spending boom is getting underway. Leading the rush to heavier spending are the metalworking and machinery industries.

Primary iron and steel companies, which had to lower spending plans because of the steel strike in the third quarter, plan to jump fourth quarter outlays by almost 50%.

This is revealed in the latest capital spending survey made by the Commerce Dept and the Securities & Exchange Commission. It shows primary iron and steel groups have slated $402 million for expansion of plant and equipment facilities during the last three months of the year.

Electrical machinery firms are planning to jump spending by about 25% and non-electrical machinery companies by a third in the last quarter.

In general, all major industries, with the exception of public power utilities, are planning higher expenditures for the last half of the year. For 1959 as a whole, capital outlays are expected to be 90% higher than a year ago.

A continuation of the trend indicated could put capital spending by the first quarter of next year at the record-breaking levels of the previous plant and equipment boom of 1955.

Manufacturers as a whole plan to spend $12.1 billion in capital outlays this year, up $1 billion from 1958. Last quarter expenditure by manufacturers is slated at 30% above year ago totals.

Most notable switch to higher spending plans occurs among railroads and commercial-type enterprises. Rails now anticipate spending better than $1 billion this year, some 40% higher than anticipated six months ago.

Electronic makers win...

Electronic companies have won the first—and most decisive—round in their battle against the aircraft industry's petition to the Labor Dept that electronic firms producing missile and plane components be required to pay the same Walsh-Healey Act minimum wage as the aircraft makers.

Right now, there's no Walsh-Healey minimum pay rate for electronics. The aircraft industry claims a competitive disadvantage in bidding for defense contracts against allegedly lower-wage electronic manufacturers. Electronic makers, in turn, object to being lumped under the aircraft industry's Walsh-Healey minimum, fear this would force up their prevailing pay for civilian production.

Labor Dept now plans to survey prevailing wages in the aircraft industry. This is the first step on the aircraft unions' plea to boost the industry's nine-year-old $1.05 hourly minimum pay rate. Plants making airborne and ground electronic gear for planes and missiles will be exempted from the aircraft wage survey, will be covered by a separate minimum wage determination. This is just what the electronic makers wanted.

But the Labor Dept is postponing a decision on what to do about electronic firms with prime contracts for missile end-items. Their plants will be covered by the aircraft industry wage survey. But this doesn't necessarily mean they will eventually be covered by the same official minimum pay rate—which is what the aircraft makers want.

Army-Air Force merger urged...

New pressures for greater military unification are shaping up in Congress. Latest push comes from the House Government Operations Committee, which calls for an Army-Air Force merger as a means of curbing mounting weapon development costs.

The committee recently made a lengthy study of the management and organization of missile projects. It criticizes the Air Force delegation of procurement responsibilities to weapon system prime contractors and the Pentagon's failure to halt duplicating hardware costs.

It also recommends that Thompson Ramo Wooldridge's Space Technology Laboratories set up as a non-profit organization. The Committee is irked by STL's role as Air Force contractor handling technical direction of ballistic missile projects.

Labor reform law...

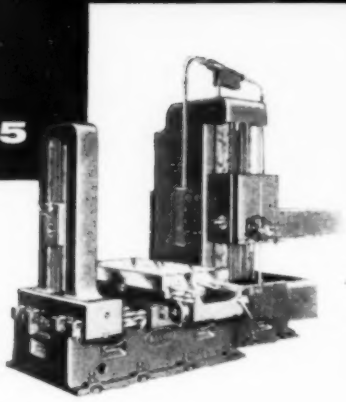
Biggest plums of the 1959 Labor Reform Law go to small unorganized metalworking employers and other small shops. The Taft-Hartley curbs in the new bill hit directly at union organizing among small businesses. It's here the unions frequently aim their pressures at the employer. The small shop employes are harder to reach and sell directly. Unions try to pressure employers into recognizing them by picketing the plant or applying pressure on a neutral employers to help in the drive—the secondary boycott. Both practices are barred in the new law.

Another boost to the non-unionized small employer is the new authority granted the states to handle small labor disputes. It means quicker legal action and often faster redress for the unorganized employer.

GET *MORE FOR YOUR MONEY

. . . with a BULLARD

Horizontal Boring Machine • Model 75



The Gas Turbine Department of the General Electric Company, Schenectady, N.Y., recently installed a Bullard Horizontal Boring Machine, Model 75. We are confident that they got more for their money.

This "*MORE" includes: —

GREATER RIGIDITY — heavier cuts at higher speeds.

PRECISE ACCURACY — hold boring tolerances to .0005.

TABLE OUTBOARD SUPPORTS — provides work alignment even with unbalanced table load.

PENDANT CONTROL — full machine control from position most advantageous to operator.

CHROME HARDENED WAYS — on Bed and Saddle for longer wear.

BED LEVELS — built into Bed for easy checking.

FAST SERVICE — after two years of operation, little trouble, and minor complaints handled promptly.

Investigate and compare and you, too — will discover you get more for your money with a Bullard H. B. M., Model 75.

ASK YOUR BULLARD SALES ENGINEER OR WRITE FOR FULL SPECIFICATIONS TO.....

THE BULLARD COMPANY
BRIDGEPORT 9, CONNECTICUT

DETROIT...

The compact slot...

The Big Three, currently previewing their new Corvairs, Falcons and Valiants to automotive writers, are as bemused as their guests on the highly interesting subject of 1960 compact car sales. They have sales goals, to be sure, but how many of these sales will be stolen, and if so, from whom?

AMC's George Romney, father of the new trend, is firmly convinced that his Ramblers will more than hold their own. "By 1965," he predicts, "compact car sales will amount to 60% of the total market, and we will account for 25% of the field." He figures that 2,250,000 "smaller" cars will be sold in 1960, and of this, 1,750,000 will be "compact." The play on words is to distinguish the imports from domestic production. Romney himself hopes to produce 500,000 Ramblers, so this leaves a potential of 1,250,000 to be shared by the three newcomers and Studebaker's Lark.

Auto executives like to think that much as the Model "T" put the nation's families on wheels, the new compact cars will put each member of the family on his or her own wheels. On this basis, each Corvair, Falcon or Valiant sale will cancel out a potential used car transaction. Prices of late model used cars, in fact, are already falling in anticipation of the market shift. What will happen to standard-sized Chevrolets, Fords and Plymouths in the lowest price bracket remains to be seen. Certainly Ramblers, Larks and imports have made no directly traceable dent in this area.

Priced at about 75¢ a pound (*AM*, August 10, 1959), the two and four-door body models available in the Corvair line range from $1810 to $1920 delivered, exclusive of taxes and transportation from the factory. There will be little chance of dickering with a dealer, as his markup has been reduced to about 20%. He needs 15% of this to pay fixed costs.

Boom in trucks...

Truck sales, expected to exceed 970,000 this year, should pass the 1-million mark in 1960, according to Herman P Sattler, head of that department at Chevrolet. He bases his prediction both on consumer optimism and the steady increase in the population of trucks aged six years or more. Nearly 58% of the nation's 10,305,000 commercial vehicles are estimated to be in this elderly bracket and would normally be due for replacement.

In a unique bit of honest self-evaluation, Chevrolet officials admitted that truck engineering of the past has not always been up to passenger car standards. Sales generated by having a product so good that it would be uneconomic not to buy it have thus been lost.

If an owner has his driver's comfort (and therefore safety) in mind, he should take a long second look at Chevrolet's new offerings, even if his fleet is less than six months old. Torsion-bar front suspension and coil springs in the rear on smaller models produce a ride that rivals that of a passenger car. AMERICAN MACHINIST's correspondent rode two tandem dumps loaded with 21,000 pounds of gravel around a pot-holed test course. One model pounded through in the spine-jarring manner expected of trucks. The equivalent 1960 version, on the other hand, floated over the route without disturbing a glass of water placed on the dash.

The christening...

Those who have wondered how auto makers go about naming cars might be interested in James Vicary Co. This unique organization, employed by Dodge to name its new Plymouth-sizes series, earned its fee by culling some 250,000 "candidates" before coming up with Dart.

Vicary gets ideas from basic lists, such as motion picture and song titles, books and plays, names of horses and other animals, and characters in history and mythology. Those selected for statistical testing must, of course, by symbolic of the product and legally acceptable.

Then some 3500 persons (two-thirds men, one-third women) check the finalists for ease of pronounciation and recall. Dart won because it had a "recall factor" of 64%.

Testing the Falcon...

Perhaps the most elaborate road test program ever undertaken is Ford Motor Company's scheme to run a fleet of 16 Falcons over every mile of federally numbered highway in the continental United States. Detailed records on gasoline mileage, handling, performance, durability and comfort will be kept. Odometer readings by the time the test is over will total well over a quarter-million miles. Yet even this impressive figure is small compared to a claimed total of 4,250,000 miles of laboratory and proving ground testing.

Ford plans to build 100,000 of its recently announced Falcons by New Year's day. A station wagon, pickup and convertible are planned to augment present sedans.

Carl:
This sounds like
what we've been
looking for. Suggest
you add it to
file
JC

COOPERATIVE CREATIVE-ENGINEERING

○ COOPERATION IN IDEAS

Greenlee engineers work with your men at all levels of management, production, and engineering. They gather and exchange information based on broad experience. These contacts accelerate creative thinking . . . one idea stimulates another. Thus cooperative creative-engineering by Greenlee puts a profit-making investment to work in your plant.

○ COOPERATION IN EXPERIENCE

Greenlee experience can save time and money in your plant. Designs are translated into profitable, low-cost manufacturing machinery when you invite Greenlee engineers to join your team. These men know the art of designing machines to avoid production problems.

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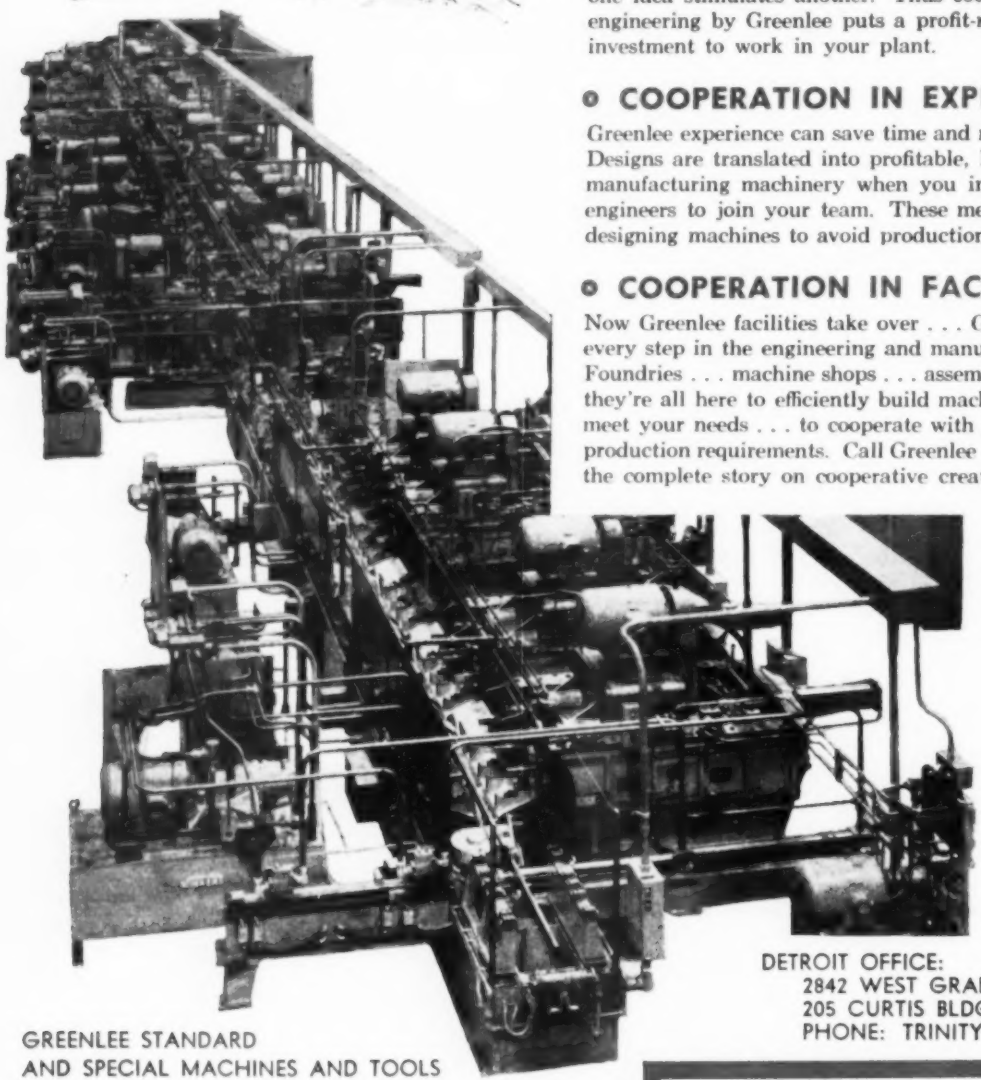
Now Greenlee facilities take over . . . Greenlee controls every step in the engineering and manufacture of machines. Foundries . . . machine shops . . . assembly floors . . . they're all here to efficiently build machines to meet your needs . . . to cooperate with you in meeting production requirements. Call Greenlee . . . let them give you the complete story on cooperative creative-engineering.



PRODUCTION MACHINERY
GREENLEE

Wm Jones:
write for available
literature and mail
this to Joe Thompson
JC

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205 CURTIS BLDG.
PHONE: TRINITY 2-3938

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- Six and Four-Spindle Automatic Bar Machines
- Die Casting Machines and Trim Presses
- Hydro-Borer Precision Boring Units
- Core Box Handling Equipment for Foundries
- Specialized Woodworking Machines
- Hand Tools for Woodworking
- Tools for Woodworking Machines
- Hydraulic Tools for Electricians, Plumbers, Contractors

Machines designed with the future in mind

GREENLEE
BROS. & CO.
1747 MASON AVE.
ROCKFORD, ILLINOIS

Joe: These people have a lot of machines in the Detroit area — look them over and let me know your reaction, Carl

AIRCRAFT and MISSILES...

TRENDS

Twilight of the unskilled...

As the nation's airframe manufacturers drift inevitably away from conventional aircraft and into the ultra-high-precision missiles and electronics fields, the unskilled and semi-skilled aircraft worker is finding it increasingly difficult to find a niche in the industry.

Airframe builders, subcontractors and labor leaders all believe that the age of mass-produced, assembly-line aircraft is a thing of the past. In today's rapidly developing technology, missiles quickly become obsolete and the only missile customer, the government, is understandably reluctant to order mass production of any missile.

A survey early this month by AMERICAN MACHINIST showed that both management and labor are markedly sympathetic to the government's dilemma, regarding abrupt cancellations of contracts as an offshoot of rapidly advancing technology.

Where does all this leave the production worker, who at one time comprised 67% of the total workforce required to build an airplane? The consensus seems to be . . . out.

Today, production workers make up 41% of the total employment force of the combined aircraft-missile industry (no big prime contractor differentiates between aircraft and missile workers as yet).

But the total employment figure is down to around 740,000 from a 1957 pre-recession peak of nearly 861,000 workers. And today, according to C Z Lindsey of the International Association of Machinists, missile employees outnumber aircraft employees 2 to 1. The percentage of unskilled and semi-skilled workers is dwindling steadily.

The Aerospace Industries Association has predicted that industry employment will probably drop off a little between now and year's end. It has also predicted that the drop in production workers will be compensated for by the missile industry within two to four years, but the emphasis will be on skilled technicians.

This IAM's Lindsey views as a heartening development, one which can only result in upgrading of workers. The unskilled worker of today, he says, who wants to fit into the changing complex would do well to take advantage of the training programs offered by virtually all major airframe builders. Few aircraft labor or management men, it seems, are too concerned with the exit of the unskilled from the scene.

Nor does the displaced production worker seem to be much of a problem, according to the California Department of Employment, because such workers traditionally have been prone to transfer from industry to industry anyway. Today, those workers leaving the aircraft industry are having little difficulty in catching on in other fields—notably the durable goods industries.

The era of skills dawns...

It is the skilled worker who is the fair-haired boy of the aircraft and missile industries today. At the moment, his position is good and his future is bright. Tool and diemakers and skilled machinists are once again in short supply, indicating a high degree of reabsorption of such men since emergence from the recession.

Employment levels have remained fairly steady in the aircraft and missile industries during the last year—proof that as the unskilled worker leaves the industry the skilled worker moves in.

Take, for instance, California's Los Angeles-Orange County area: aircraft-missile employment has risen from 174,000 in July 1958 to only 176,900 in July of this year. This in itself has not been enough to create a shortage of skilled technicians such as exists today. Rather it is the missile-related electronics industry that has been snapping up skilled personnel at a dramatic rate. . . Figures for the twocounty area show that employment in the electrical machinery industry (mostly electronics firms) jumped from 88,400 in July 1958 to 108,100 in July 1959.

Skilled have problems, too...

Even so, the skilled worker is not without his problems. For one thing, contracts aren't as firm as they used to be, putting the worker in an untenable position. That's why IAM's No. 1 goal today is to get some assurance of continuity of employment for its members in an era of large-scale contract cancellations and increasingly frequent relocation of facilities.

"The government's insistence that contractors locate where the government wants them to locate in order to secure contracts works a hardship on employees," says IAM's Lindsey.

He is particularly critical of the Air Force's refusal to provide subsistence pay to facilitate transfer of skilled workers—"I'm slowly coming to the conclusion that the locations are being dictated not by needs for decentralization or safety, but rather by contractors looking for a cheap labor market, or trying to get out of what they consider an onerous labor contract."

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MACHINE TOOLS...

A look ahead...

Fourth quarter metal-cutting machine tool outlook, as reported by builders across the nation, is excellent. Outlook in the closing months of 1959 for metalforming machine tool new orders may be considered good, although the improvement will be more gradual than that for metal-cutting machines.

It is by now a certainty that 1959 will show a spectacular improvement for the machine tool industry as a whole over 1958. The one factor that could cloud the outlook, however, is strike-caused steel shortages, which are already having an indirect effect on the machine tool industry —machine tool builders themselves are for the most part well stocked on steel, but customers are beginning to feel the pinch and if shortages grow more intense new orders for machine tools could be affected.

Nevertheless, machine tool shipments are expected to reach the year's high point in the fourth quarter.

But backlogs, which have been steadily growing for several months, may have their growth retarded in the next few months if (1) steel supplies are not replenished soon, and (2) the automotive companies don't come through with long-delayed machine tool buying programs.

Automakers, incidentally, have gone just about as far as they can in holding off on major buying programs. Recent practices of rebuilding and modifying existing equipment and of buying new machine tools from hand to mouth just won't do in the face of rising production, particularly if the Big Three's compact cars go over as well as expected with the public.

This same need for replacement and plant expansion holds true for other of the so-called consumer hard goods industries, notably appliances and farm equipment, which are now experiencing a resurgence after long recession periods.

Thus if fourth quarter new orders and shipments live up to expectations, machine tool sales managers will be able to point with pride to gains of anywhere from 50% to 500% over 1958.

These spectacular gains, however, really mark a return to what the industry believes are normal levels, so that while workforces are increasing and six-day weeks are common, full utilization of builders' capacities and second shifts definitely is not the rule as yet.

Here are some examples of business outlook reported by various segments of the industry:

Milling machine sales are currently running a little ahead of second quarter levels, will continue to improve gradually through fourth quarter 1959 and first quarter 1960. Total 1959 sales should wind up about 25% ahead of those for 1958. Some builders report 40 to 45 hour workweeks, with two or three shifts working in some areas. Employment is about 10% ahead of comparable 1958.

Grinding machine manufacturers are looking for about a 25% improvement in fourth quarter new orders over current levels, and that means a jump of 70% or so over year-ago levels. A further improvement of 10% is expected in the first three months of 1960. When 1959 figures are in, total sales should top those for 1958 somewhere between 50% and 90%. Workweeks vary from 40 hours to 55 hours. Employment is up 10 to 15% over 1958, and backlogs have increased to 18-20 weeks.

Makers of gear hobbing equipment report sales are currently running far ahead of comparable 1958, that this year's business will be at least double that of last year. Fourth quarter predictions vary widely, however. One maker anticipates a high fourth quarter (double that of the last three months of 1958), whereas another thinks sales may dip slightly through first quarter 1960. Backlogs are nearly double those of a year ago. Workweeks run 40 to 47½ hours. Employment is up slightly.

Rate of sales for drilling machines is 75% to 90% ahead of last year. Outlook is for continued improvement at least through the next six months.

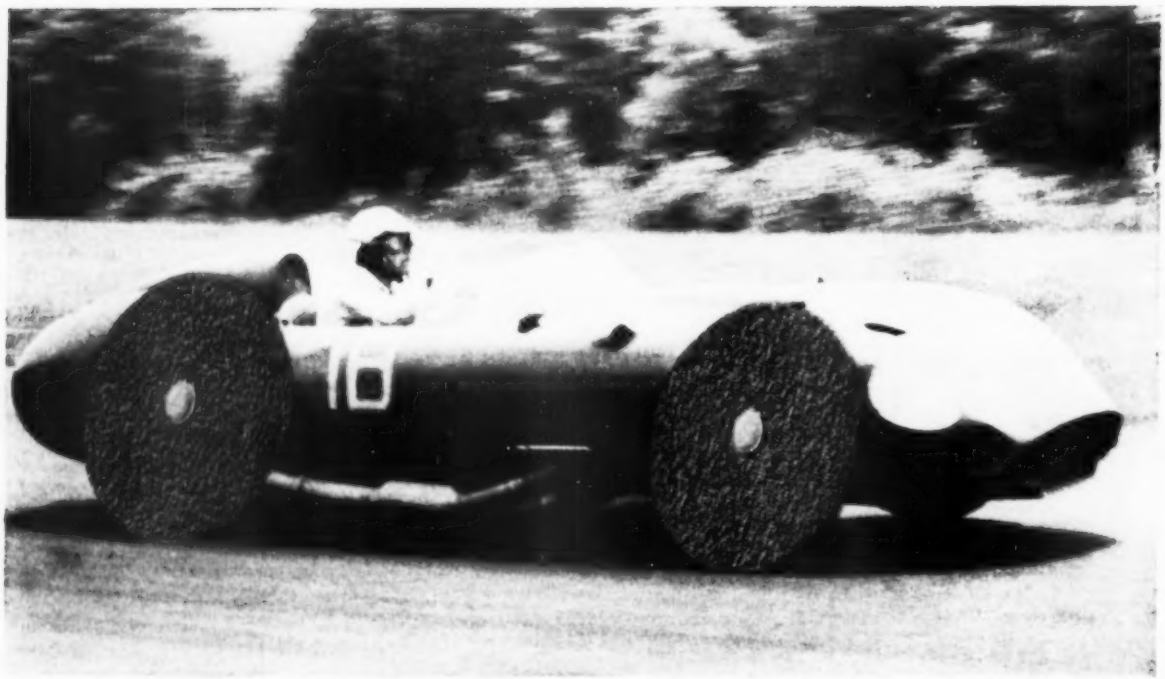
Sales upsurge is not attributable to any one industry, rather to vastly improved business conditions in all segments of metalworking. Employment, depending upon individual companies, is up anywhere from 20 to 75% over 1958. Workweeks stand at about 50 hours, backlogs at five months.

Makers of lathes say that 1959 sales will triple those for 1958. Sales are now ahead of those for the second quarter, are expected to remain at high levels through first quarter 1960. Backlogs are at 4 to 5 months, compared with 2½ to 3 months a year ago. Employment is up about 30%, and workweeks stand at 40 to 45 hours.

Press sales are climbing slowly. Fourth quarter 1959 looks good but beyond that press builders aren't too certain. Depending upon the manufacturer, 1959 sales may exceed those of last year by anywhere from 25% to 100%. Backlogs are up, as is empolyment. Workweeks range up to 54 hours.

Orders from abroad have increased as much as 25% this year, are still growing.

For Speed and Mileage . . .



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MATERIALS...

Steel strike strengthens competition

No matter what happens short of quick settlement on reasonable terms, the steel strike has opened an ever-widening hole in the industry's armor of acceptance. Competitive materials are having a field day. And, even with the strike settled, it will be very difficult to turn the tide this opportunity has put in motion.

This loss of business, much of it permanent as opposed to temporary strike losses, is likely to cost many millions of dollars of income to the steel companies and, in turn, the steel workers.

The timing is ideal for the competition. As Industry rolls back into high gear from the recession, in an atmosphere of accelerating materials development, manufacturers are seeking quality, price and delivery advantages.

Never before have the producers of aluminum, magnesium, zinc, plastics, glass, cement, and other materials had the range of mechanical and decorative abilities that they offer today. Never before has the price differential been so close. Never before have the sales efforts of these producers been so well organized and integrated.

Recognizing their plight, the steel companies are fighting back. But the fight is on a number of fronts, one of which is the resistance of their own union, and a multi-fronted battle is hazardous.

On the one hand the steel producers are stepping up their merchandising activities. In another area they are combining their popular materials with glass, ceramic, aluminum, etc, to provide the desirable characteristics of both materials.

At the bargaining table the steel producers are struggling to retain the price advantage they now enjoy over most competitive materials. But the strike damage cannot be undone. At best, the steel industry will lose valuable ground.

The push is on...

Publicly, steel industry spokesmen will chuckle at the mention of other materials competing. After all, the steel industry sells more steel for cans alone than the entire output of the aluminum industry. Who can "compete" with nearly 150 million tons a year rated capacity?

Privately, these people will admit that the constant nagging hurts, perhaps not broadly but sharply in specific sales areas. It isn't so much the volume of competitive materials sold as it is the *rapidly accelerating growth* of sales enjoyed by the suppliers of these materials that worries the steel people. And the wound is irritated by the growing volume of cheap imported steel.

Aluminum is being pushed particularly—and some breakthroughs have been made. Typically, an experimental all aluminum bridge is reported to be under serious consideration by two state-highway departments.

For the first time in the US, a sizable order for aluminum freight cars has been placed. And, as previously reported in AMERICAN MACHINIST, aluminum has a firm footing in the can market.

Aluminum ships are on the development horizon and the industry believes that the market for aluminum military vehicles offers greater volume than the market lost by the swing to steel aircraft. This would be a serious blow to steel in a field it has traditionally called its own.

Look at the plastics industry. As coatings, plastics are reducing the thickness requirement of steel sheet and strip. At Westinghouse plastic beads expanded between two sheets of aluminum are used to form the outer shell of a refrigerator—traditionally a place for steel.

DuPont marketers expect sales of flexible polyethylene plastic pipe will hit 60 million pounds this year, largely for irrigation use. While, at an eight-to-one weight ratio, the 250,000 tons of steel this plastic pipe might replace is not critical in terms of steel volume, it is a 50% increase in the sale of plastic pipe over 1958.

Manufacturing cuts price margin . . .

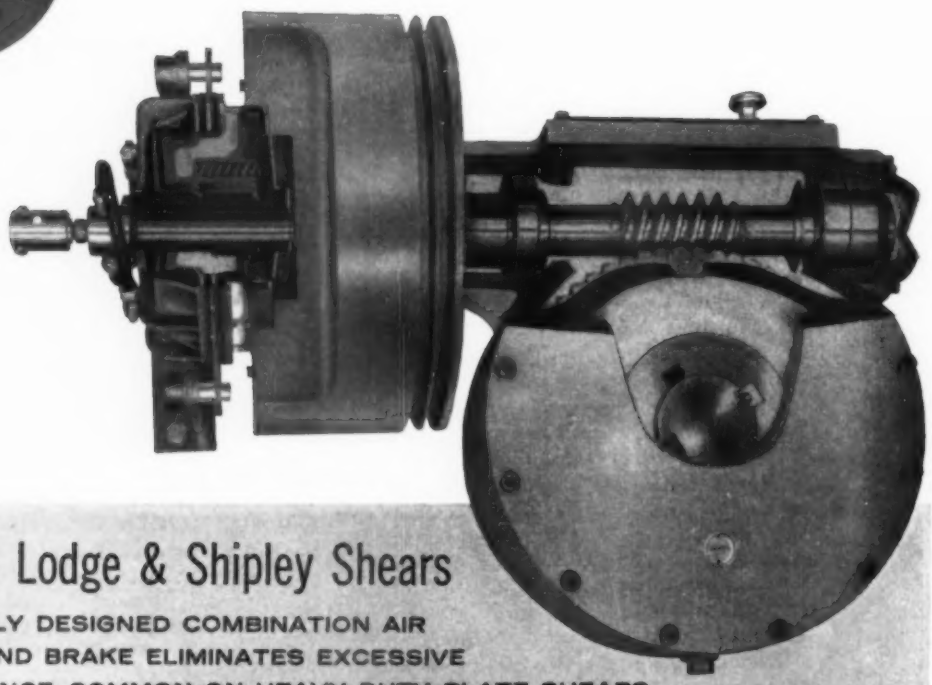
Generally, steel leaves the mill with a substantial price advantage over most competitive materials. It's a hard to beat ace in the hole. Producers of materials capable of replacing steel, however, are constantly developing easier ways to work their products, to reduce this advantage.

DuPont's new plastic "Delrin," for example, costs 8 to 12 times as much as steel but it can be injection-molded into a finished part in one operation while steel requires several finishing operations. Thus, the company says, items such as the small gears and conveyor chains about to go into production will cost "about the same" as when made of steel.

At press time, there is no sign of the strike ending. Even with only occasional, random shortages steel's competitors have made inroads. If the strike lasts through Oct 31, when most big consumers are expected to run out of strike stockpiles, replacement materials will be in demand.

Even now, designers are considering the changes necessary to get along without steel. Unless the strike is settled soon and without a price increase, the entire industry will suffer far beyond the direct cost of the idleness.

EXTRAS on the machine . . . not on the invoice!



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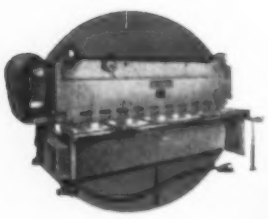
- Air-cushioned Back Gauge • Blade Changing Jigs
- Fast, One-man Upper Blade Adjustment
- Independent Holddown Fingers • Quad-life Worm Gear



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WHAT'S AHEAD... in Metalworking

Gray market in steel...

From the nation's metalworking centers come reports that a gray market in steel is already with us. And it looks as though by October's end the gray market may turn a darker shade.

October 31 seems to be the date when even blue-chip consumer corporations will hit the bottom of their strike stockpiles. Smaller firms, with less capital to invest as a hedge against shortages, will run out sooner than that.

At press time, settlement of the steel strike was nowhere in sight. Add to that the time it will take the steel mills, operating at top capacity, to get the nation's inventory up to par, and you come up with the incontrovertible fact that steel will be in short supply for many weeks to come.

One top midwestern metalworking firm admits to paying 1½¢ over warehouse price for hot-rolled sheet. Figuring the warehouse price at 1½¢ over mill price, this company is paying 3¢ over what it should normally.

And this case is far from uncommon. Premiums will get bigger and bigger as consumers get more desperate. Still, there's very little chance that gray market prices will reach the levels they did during and after World War II—10, 12 and 14¢ above normal warehouse prices.

Certain specialty steels are already in extremely short supply. One appliance manufacturer, for example, fears it will have to close down its toaster line by September's end, simply because it can't get a certain narrow gage steel. Not only that, this company's existing inventories of specialty steels are beginning to warp and will have to be re-rolled.

A manufacturer of machine tools had this to say recently, "I am shocked at how much influence the steel strike has on business activity in this country. Our product is a long lead-time item, and business people admit that the strike will be settled long before we could make delivery on machine tools ordered today. Yet they don't even want to discuss new equipment until the steel strike is over."

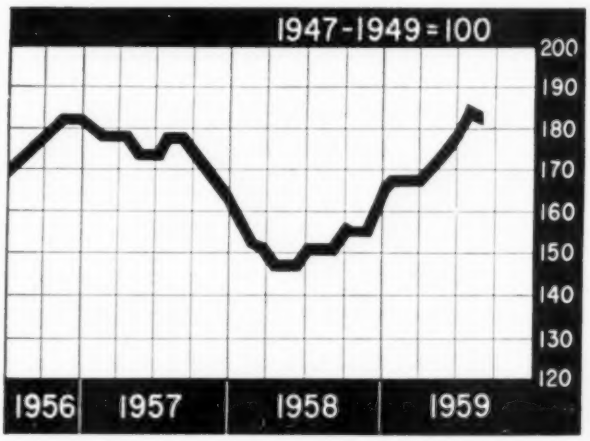
Stamping shops aren't cutting back production yet, but they're fast running out of some items, particularly pre-finished steel (terne plate).

Also in short supply is 20-gage sheet. One company has already been approached by a small off-beat warehouse, which is offering gray market coil and strip for around $12.75 a cwt, more than $5 a cwt over usual mill prices.

Sheet metal job shops, some of which are pretty well stocked on ¼-in. plate; 16, 10 and 11-gage sheet; and galvanized are being asked by warehouses to help them out by supplying as much as they can to the warehouses' customers.

Steelmakers are afraid that this year's strike will cause "irreparable damage" to this country's steel industry in that desperate customers are buying imported steel (shipped in via the St Lawrence Seaway to midwestern ports) because they can't get the domestic product.

Steel imports have more than doubled since the strike began. If buyers continue to purchase that amount of foreign steel even after the strike's end, Republic Steel Chairman Charles M White estimates 3-million ingot tons would be sold here annually—equal to the output of Republic's Cleveland plant, which employs 9500 people, has a payroll of nearly $70 million a year.



AMERICAN MACHINIST INDEX OF METALWORKING PRODUCTION

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

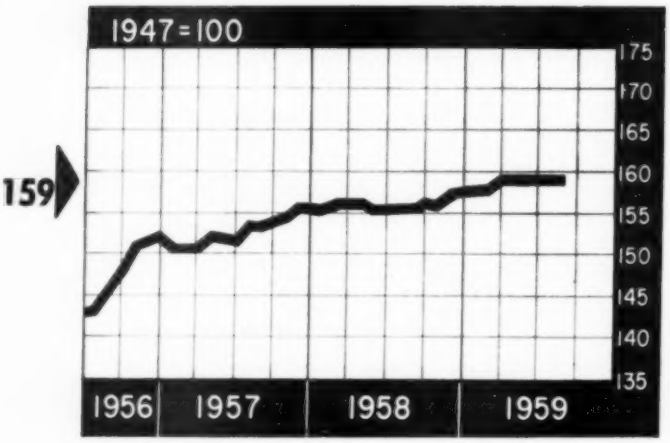
	AUG Estimated	JULY Preliminary	JUNE Revised	JULY Year Ago
Total Index	**183**	**185**	**183**	**178**
Machinery	155	154	126	
Electrical Machinery	220	218	181	
Autos	141	139	84	
Other Transportation	351	351	333	
Other Metalworking	159	158	135	

TRENDS

WHAT'S AHEAD... in Business

AMERICAN MACHINIST INDEX OF METALWORKING PRICES

	AUG Estimated	JULY Preliminary	JUNE Revised	JULY Year Ago
Total Index	**159.0**	**158.8**	**158.7**	**155.8**
Metalworking Machinery ...	185.6	185.3		181.2
Other Machinery exc. Electrical	169.8	169.7		166
Electrical Machinery ...	160.2	160.0		158.9
Fabricated Metal Products	148.8	148.8		133.1



Spotlight on profits...

Total corporate profits for 1959 will hit a record of about $50 billion before taxes. Some major corporations will be doubling last year's recession-level profits. But there are some important factors to keep in mind when thinking about the current profits picture.

Profit margins are up substantially over last year, but are still well below levels of other recent years. Profit per dollar of sales, for example, is below the level of other boom years such as 1955. Record total profits are thus a reflection of a record volume of sales, and not an indication of windfall gains going to business.

Profits as a percent of total national income, too, are below levels of other postwar years (national income is the total of the earnings of business, labor and property owners). Thus, although profits are at record high levels, wages and salaries have been growing faster than profits, and are now taking a bigger share of total national income.

Increased dividend payments will take up much of the profits remaining after taxes. About half the $50 billion of corporate profits this year will go to taxes. Somewhat more than half of the remainder will be distributed to stockholders as dividends. Corporations thus won't be holding on to as much of their earnings as they did in earlier postwar years.

Corporations should have on hand a total of $41.5 billion for 1959—$11.5 billion in retained profits; $22.5 billion in depreciation allowances (reported in the McGraw-Hill survey last spring) and $7.5 billion that they'll realize through sales of stocks and bonds to the public. That amount is more than enough to cover the $33 billion of capital spending corporations say they'll do this year, so the new tight money squeeze won't affect overall business plans.

But business will be needing even more money in the future if obsolete plant and equipment are to be replaced, and added facilities provided to meet growing demand.

WEEKLY BUSINESS INDICATORS	*Latest Week*	*Preceding Week*	*Year Ago*
Business Week Index of Activity (1947-49=100)*	149.8	149.9	135.0
Steel ingot production (thousand tons)	337	332	1,780
Electric power output (million Kilowatt hours)	13,759	14,109	12,025
Production of automobiles and trucks	31,541	33,629	16,798
Engineering construction awards (Eng. News-Record, millions)	$338.7	$490.1	$360.7

MONTHLY BUSINESS INDICATORS	*Latest Month*	*Preceding Month*	*Year Ago*
Refrigerators sales (thousands of units)	378	361	280
Vacuum cleaners sales (thousands of units)	221	274	264
Washers sales (thousands of units)	318	342	277
Household electric ranges sales (thousands of units)	67	77	56
Radio production (thousands of units)	329	1,430	774
Television production (thousands of units)	350	571	275
Gear sales index (1947-49=100)	262.8	274.2	133.3
Foundry equipment new orders index (shipments, 1947-49=100)	N.A.	125.1	77.9

N. A. Not Available
* Seasonally adjusted

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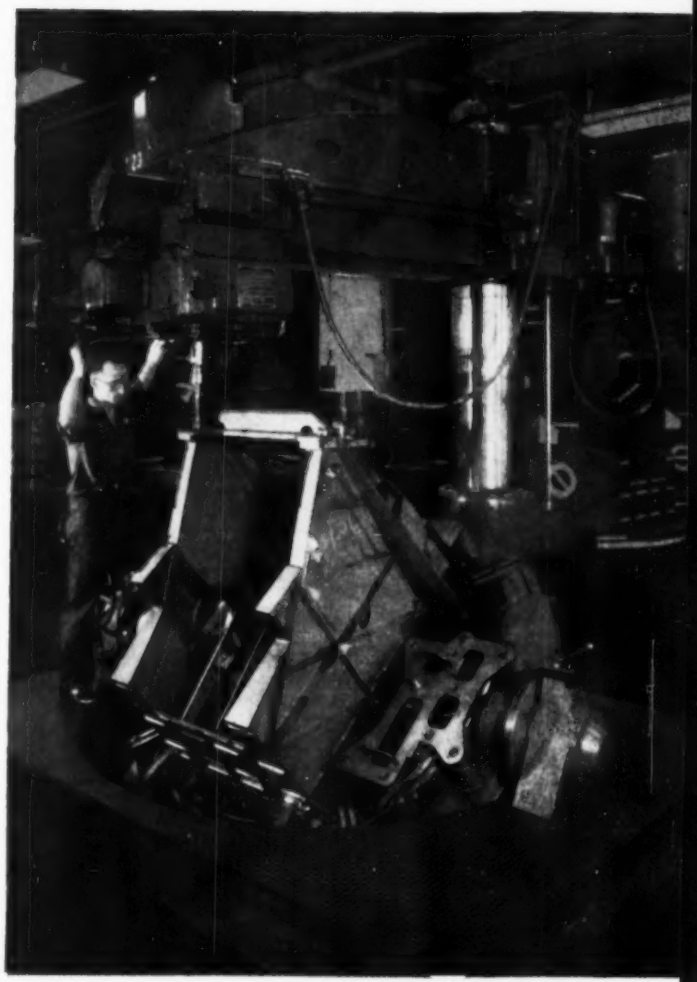

The time on this job was cut to the bone by the combination shown by the illustration. All boring, facing, drilling, tapping and counterboring on the entire job was done in one work setting by means of an ingenious swiveling fixture.

The essential contributor to satisfactorily performing this variety of work is unquestionably the "AMERICAN" Double Lo-Hung Spindle Drive. This is an exclusive "AMERICAN" Hole Wizard feature. It divides the speed range into two separate ranges; the high speeds through a comparatively small gear to minimize gear velocities; the low speeds through a large diameter, wide faced gear to reduce gear tooth pressures to insure minimized wear under severe service.

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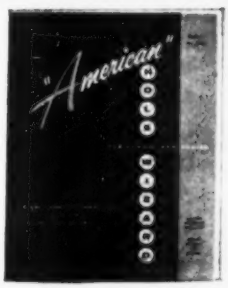

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Unretouched photos (above) . . . dramatic proof of Chicago-Latrobe "LO-TORK" Drill's chip breaking effectiveness. Conventional drill at left; "LO-TORK" at right. Same workpiece in each photo.

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THE MAGAZINE OF METALWORKING MANUFACTURING • ESTABLISHED 1877

Make the Most of It

Few industries have matched the performance of the metalworking industry since 1950.

In sheer size, measured by plant facilities, Metalworking is 85% bigger than it was at the beginning of this decade. Most of this expansion has been since the end of the Korean war.

Production of metal goods...

likewise has grown spectacularly during the 1950s. Physical output, using the AMERICAN MACHINIST index as a guide (1947-1949=100), has climbed to a new high of 183 this year.

Metalworking thus has rung up a record of growth that is the envy of many another industry. It has consistently operated at a level considerably above industry as a whole.

If you are lured by glamor industries, remember that such glamor industries as aircraft and missiles and electronics are part of Metalworking. These industries have contributed handsomely to Metalworking's impressive showing.

On the threshold...

of a new decade, where is Metalworking going? The answer to this question is set forth in a Special Report starting on page 141.

Metalworking is destined for big things in the 1960s. Plans are in the making for further expansion of capacity. Plans also are afoot for modernization and replacement of existing plant and equipment to take advantage of the rapidly developing new technology. A thumping $5.2 billion is estimated to be spent for expansion and modernization of production facilities in 1962, a sharp gain over the $3.5 billion this year.

Billions will be poured out for research and development. R&D spending this year, at $7.1 billion, is more than 2½ times what it was only five years ago. And within three years the outlay per year will have risen to $8.4 billion.

All signs point to the fact that Metalworking production will bowl along at a fast pace the next few years and by 1962 will be 25% better than now.

The steel industry...

which supplies the raw materials for the bulk of the nation's metal products, has taken heed of these signs and is adding to its capacity. The new steel-making facilities, mind you, are on top of terrific expansion the past decade.

So, as you contemplate the years immediately ahead, keep in mind that Metalworking is on the verge of an impressive growth period. The growth obviously will not stop with 1962. It is likely, with the exception of a few setbacks here and there, to go right on through the entire decade.

Your plans therefore should be made accordingly. If you do ont participate in the growth, your competitor will. A prosperous era looms for you. The thing to do is to make the most of it.

Burnham Finney EDITOR

RUGGED PRECISE ECONOMICAL

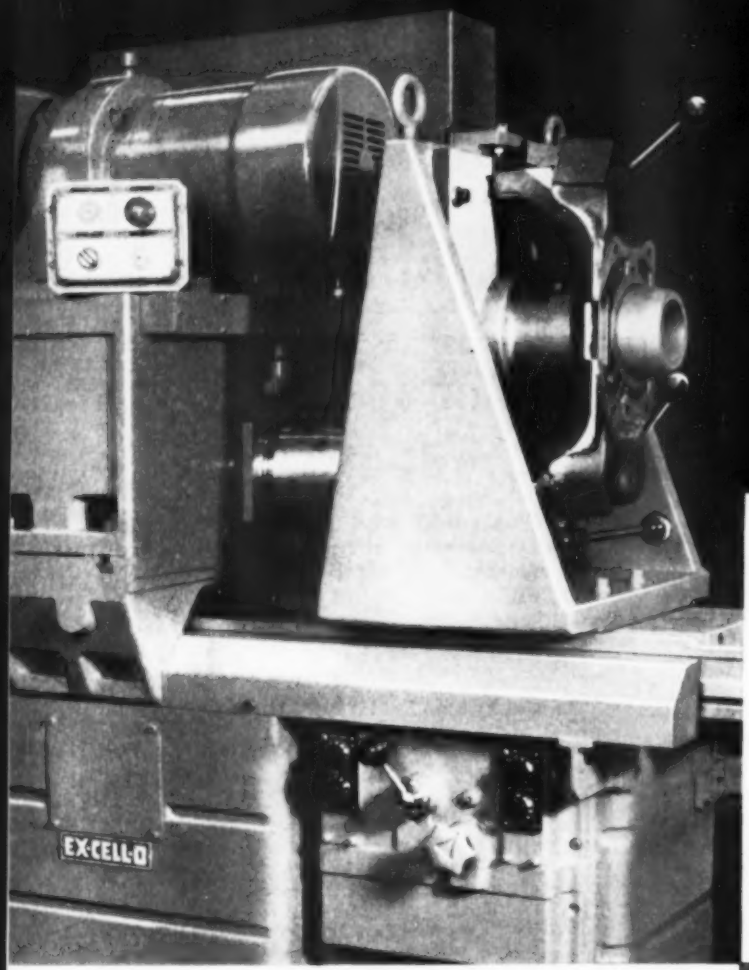
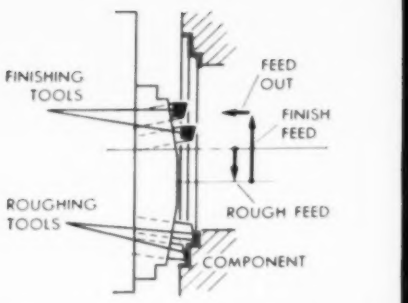


Table pad of the compact Style 2112-B provides ample space for this rugged fixture. Work is shown clamped in position.



Machining cycle and tooling are outlined above, with roughing tools shown fed to depth; finishing is done at opposite end of the feed stroke.

Starter motor mounting of this cast iron clutch housing is faced and bored from rough to finish in one cycle.

59-18

Ex-Cell-O Style 2112-B bores, faces heavy casting in a single cycle

RUGGED for roughing—PRECISE for finishing—ECONOMICAL for short runs

Precision built for boring, turning and facing small or medium-size parts, the Ex-Cell-O Style 2112-B Precision Boring Machine is equally adept at tackling a heavy cast iron truck clutch housing.

The job is done quickly and accurately in one cycle. After clamping, rapid traverse brings the work into position for roughing tools to face two shoulders and plunge two bores. Feed is reversed for finish facing, and table feed-out doubles as a finish-bore pass. A standard hydraulically-operated Ex-Cell-O Facing Head carries the tooling.

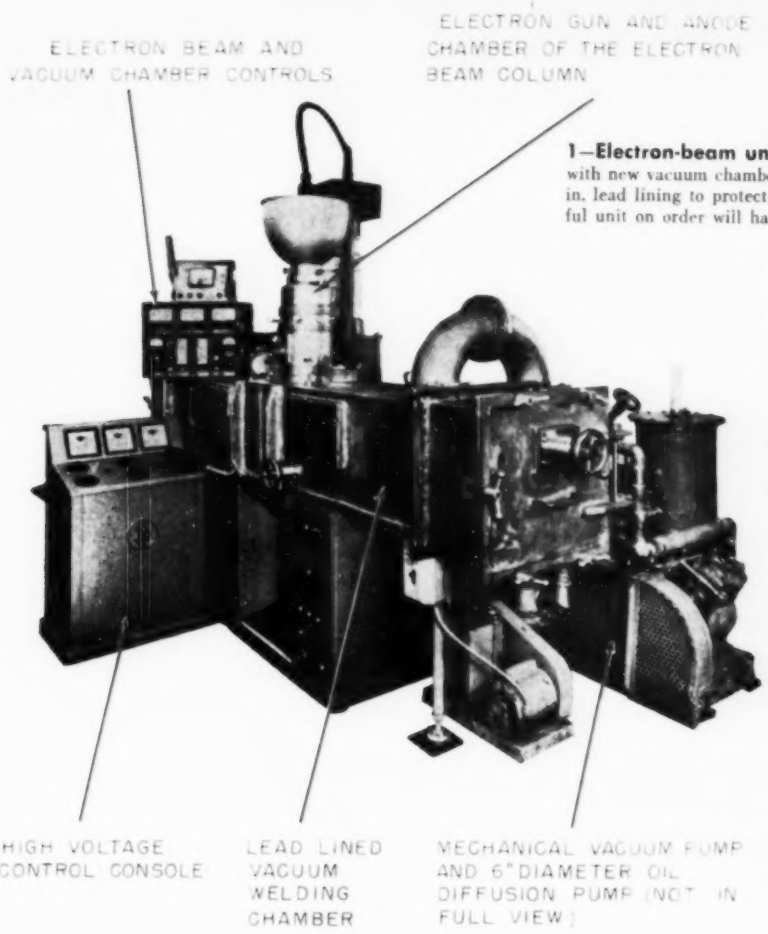
Find out how the Style 2112-B or the double-bridge Style 1212-B can put similar flexibility into your operation. Write direct, or ask your local Ex-Cell-O Representative about combining these rugged, time-tested Precision Boring Machines with low-cost tooling for real economy in long runs or limited production.

EX-CELL-O FOR PRECISION XLO

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN
Machinery Division

EX-CELL-O PRECISION PRODUCTS INCLUDE: MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • TORQUE ACTUATORS • THREAD AND GROOVE GAGES • GRANITE SURFACE PLATES • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT.

CIRCLE 252 READER SERVICE CARD


ELECTRON BEAM AND VACUUM CHAMBER CONTROLS
ELECTRON GUN AND ANODE CHAMBER OF THE ELECTRON BEAM COLUMN
HIGH VOLTAGE CONTROL CONSOLE
LEAD LINED VACUUM WELDING CHAMBER
MECHANICAL VACUUM PUMP AND 6" DIAMETER OIL DIFFUSION PUMP (NOT IN FULL VIEW)

1—Electron-beam unit makes 40-in. welds . . . with new vacuum chamber that measures 15 x 15 x 94 in. and has ½-in. lead lining to protect operator from X-rays. A larger, more powerful unit on order will handle "the largest nuclear fuel assemblies"

How good is electron-beam welding?

Early reports on electron-beam welding have told how the process works and what its outstanding advantages are (*AM*—Feb 23 '59, p95). But how does it compare with other kinds of welding, and what are its prospects as a production welding technique?

Westinghouse Electric Corp has made a thorough study of these questions at its Bettis Atomic Power Laboratory and has voted in favor of the new process, at least for certain applications. W L Frankhouser and G Burton report in a technical paper that the company has ordered a second high-voltage electron-beam welder. The paper will be presented Sept 30 at the American Welding Society's Fall Meeting in Detroit.

The authors say, "This unit will be mounted on a specially designed prototype production chamber in which the largest nuclear fuel assemblies can be processed. A pilot production welding process for both subassemblies and clusters will be developed."

The 1-kilowatt unit that has been in operation since July 1958 has proved it can make 0.250-in.-thick butt welds in Zircaloy-2 at a speed of 10 ipm. Welds 0.100 in. deep have been made at 30 ipm. "Chemical analyses, metallography, corrosion tests, and mechanical property evaluations have revealed satisfactory properties in the Zircaloy-2 welded by this process." Thus, it appears that the process has successfully survived the phase of laboratory investigation.

Of course, the main reason for its success in welding a reactive material like Zircaloy-2 is that the process operates in a high vacuum. At a pressure of only about 0.03 micron of mercury, there is practically no atmosphere left in the welding chamber to cause contamination. And, unless the high vacuum is maintained, the electrons will not travel from the cathode to bombard the work.

High depth-to-width ratio

A particular advantage of the equipment employed at Westinghouse is the high concentration of thermal energy at the workpiece. Because of this feature, the machine can make welds with a depth-to-width ratio of 2:1 in Zircaloy-2, and a ratio of 3:1 has been achieved with special machine adjustments. (A recent announcement by Electrona, Inc, US representative for Carl Zeiss electron-beam equipment, tells of a 20:1 weld made in stainless steel with the same equipment. See *AM* July 27 '59, p3).

But what does this mean in actual processing? Primarily, it means a narrow fusion zone and heat-affected zone, and it means less shrinkage and thermal distortion. The equipment also maintains "remarkably uniform weld penetration."

The cross-sectional sketch in Fig. 2 shows how these features help in fabricating a typical assembly of nuclear-core plate-type fuel elements. The comparison is between electron-beam welds and inert-gas, tungsten-arc welds.

The design of the assembly requires 100% penetration at the 0.100-in. weld joints. However, excess penetration is undesirable, especially if it extends over the heat-transfer area of the fuel. At the same time, the fusion zone must be kept narrow so the adjacent, unwelded seam will be visible when its turn comes to be welded.

"The deep penetration of electron-beam welds minimizes the amount of over-penetration and avoids the obliteration of adjacent seams. With the tungsten arc process, the seam adjacent to the last seam welded becomes covered by the fusion zone, and accurate tracking is difficult.

Reduced shrinkage

"The lowered total energy input to the weld by the electron beam effectively reduces the shrinkage and thermal distortion to which the workpiece is subjected. Total transverse shrinkage per weld seam has been 0.010 to 0.012 in. for tungsten

arc welds and only 0.001 to 0.002 in. for electron-beam welds."

However, Frankhouser and Burton carefully point out that these benefits are possible only with high-voltage electron-beam equipment. The machine employed at Westinghouse ". . . was manufactured by Carl Zeiss of West Germany and differs radically from American electron-beam welding equipment. . .

High voltage vs low

"Contemporary domestic equipment has been developed primarily for operation in the 5 to 50 kilovolt and 0.1 to 0.75 ampere ranges at maximum electron-beam power of about 7.5 kilowatts. The high-voltage equipment operates at 50 to 100 kilovolts at less than 0.01 ampere and at a maximum beam power of 1 kilowatt.

"Three electron guns which operated between 2 and 15 kilovolts have been tested at Bettis, and several other units have been examined at other installations. In all cases, depth-to-width ratio of the weld fusion zone has been no more than equivalent to that obtained with the tungsten arc welding process.

"At the same time, consistent and uniform weld penetration in Zircaloy-2 was limited to 0.050 in., and slow welding speeds, multiple welding passes, and comparatively large total energy inputs were required for low-voltage equipment, while a depth of 0.250 in. at 10 ipm welding speed has been obtained with the 1-kilowatt high-voltage welder."

How about costs?

But, with all its advantages, how does high-voltage electron-beam welding stack up on costs? As the authors say, "A substantial reduction in process costs is required to amortize the current high capital costs of the welding equipment if the process is to be considered competitive with the conventional welding processes."

The main factor here is the greatly reduced distortion because of lower energy input. The special spacers (Fig. 2) will be eliminated; post-weld match machining will be reduced; and special straightening operations will no longer be necessary. Extension-bracket welding will probably be combined with subassembly welding—during the same chamber evacuation.

In addition, deep penetration will eliminate the need for multiple passes and filler wire additions. And the vacuum will permit fuel elements to be welded without removing the corrosion film left by previous corrosion tests and will permit elimination of subsequent corrosion testing of fuel assemblies.

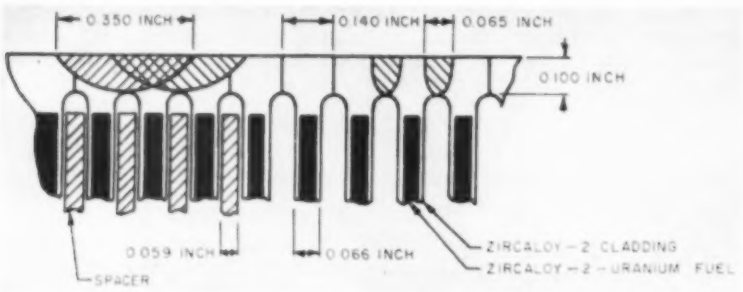
Overall savings: 8%

Taking all these savings together, ". . . it appears that there is a potential cost reduction of 35 to 40% in direct labor costs and of approximately 8% in the overall cost of a typical fuel assembly."—enough of a saving, apparently, to justify the purchase of a second high-voltage welder for production applications.

The new one will be more powerful—capable of welding at 150 kilovolts with a maximum beam power of 2 kilowatts. But the engineers are looking for other improvements, too.

The controls on the present 1-kilowatt laboratory unit are so sensitive that it's very difficult to reproduce a specific setting on the machine. In addition, heat build-up could become a serious problem in production welding because of the longer welds and, often, a large number of welds on the same assembly.

However, both Westinghouse and Zeiss are working on the problems, and the new machine is expected to have many improvements over the present one.



2—Tig welding vs electron beam . . . in cross section through a typical nuclear fuel assembly. Wide tungsten-arc welds (left) spread over adjacent joints and make subsequent tracking difficult. Narrow electron-beam weld gives better control over penetration and reduces shrinkage; spacers are not needed

3—This is a one-pass weld . . . made in 0.400-in.-thick stainless steel with an electron-beam welder. No filler metal was added; bulge on face is probably an expansion effect. Electrona, Inc, says the weld was made by a 1-kilowatt unit with special adjustments

TWO CHECKS
for angle-contact ball bearings

By Richard Smith,
chief engineer,
McGill Mfg Co,
Valparaiso, Ind

How to determine the angle of contact, and how to match a pair of angle-contact ball bearings, are two important techniques that are not usually covered in texts on ball bearings. Both jobs can be handled with simple setups and minimum equipment.

The contact angle is important because it affects bearing capacity, especially if the angled bearing is to be applied in pure thrust. The bearing is placed on a flat plate with the open race up. Identifying pencil marks are made on the races and retainer. Then the inner race is rotated ten turns—with a 10-lb weight on the inner race for highest accuracy. Rotation of the retainer is counted, then figured into this formula:

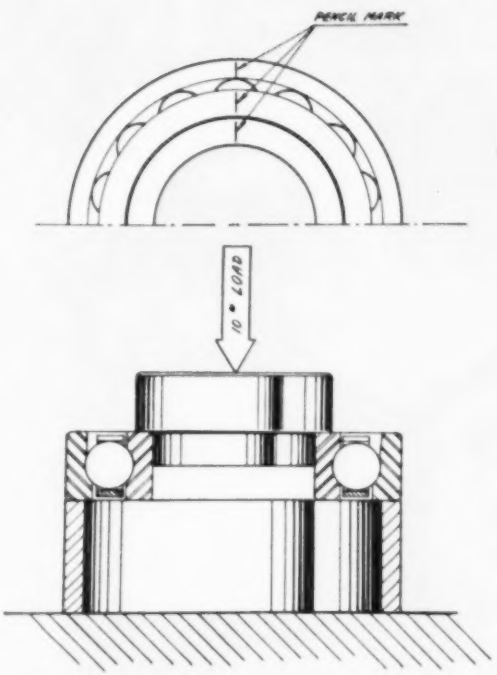
$$\text{Cos } \theta = \frac{(1\text{-}2R)\ A}{I}$$

Where A is $\frac{P_d}{B_d}$, θ is rotations of the retainer, I is rotations of the inner race, P_d is pitch diameter of the bearing, and B_d is the ball diameter.

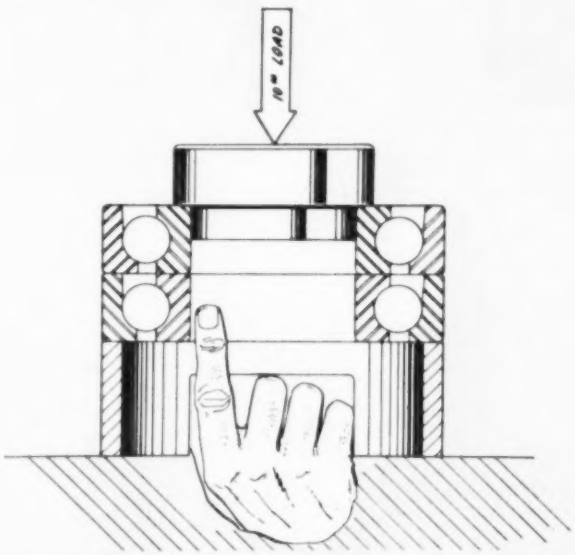
The contact angle can be calculated directly. This can be compared with specifications for the bearing.

Matching up a pair of angular-contact bearings can also be handled on a flat table, but with one bearing on top of the other, with both open races up. The bearings are centered on each other, then weighted with 10 lb. which rides on the inner race. If any of the races are free to rotate individually, the bearings are out of match. As much as 0.0005-in. clearance or interference between race faces is considered maximum out-of-match condition for heavy-load applications. Shims can be inserted to gage the exact amount the bearings are out of match.

Matched bearings will split a joint load evenly, so neither is overloaded.



Contact angle is figured by rotating the inner race, then comparing that figure to rotations of the retainer



Matched pairs can be checked with this setup. Inner races should rotate together, even if top bearing is placed underneath

Verti-slide

By B F Burnham,
manager, manufacturing engineering, and

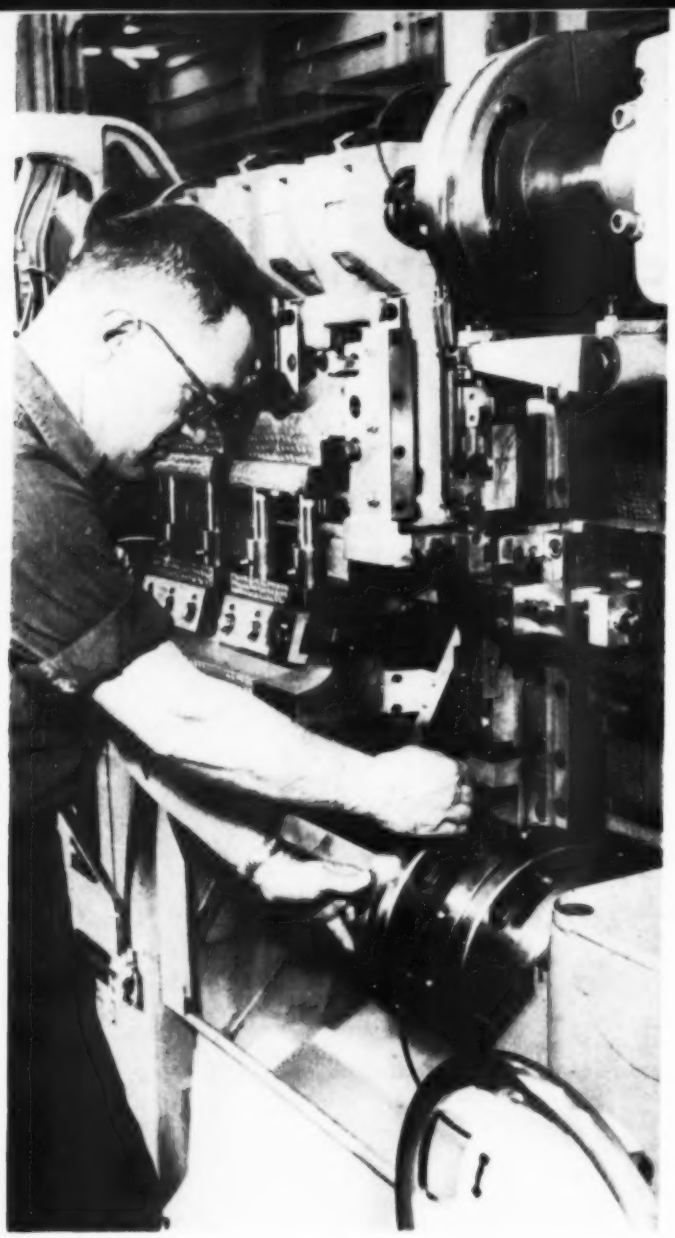
R C Pedrick,
manufacturing engineer,
General Electric Co, Shelbyville, Indiana

Unusually fast writeoff for production equipment is credited to a newly installed vertical four-slide machine that forms sheet-metal wiper dies for GE's industrial-heating department. The machine saves $13,500/year compared with older methods at five or six OBI presses, and it can produce the entire yearly requirement of the parts—150,000 pieces—in three 8-hr shifts.

The wiper die is formed of 0.021-in. phosphor bronze, and must be made so its two jaws exert exactly 1000-gm pressure at 70 F. The part is not particularly complex, but there are 26 critical dimensions that must be held. The parts are used in batches of 100-120 in wire machinery where they apply 0.001-in. coats of enamel to the wire. Because of rapid wear and natural loss of tension, the parts are required in large quantities.

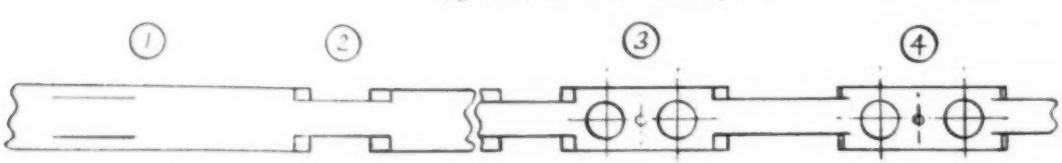
Forming actually starts at two punch presses, where the bronze strip is slit, notched, pierced, and bent. Stock feeds directly into the four-slide machine, a Verti-Slide made by Torrington Mfg Co, Torrington, Conn. The Verti-Slide completes forming in four operations (see photos and sketches).

More than 20 other wire and strip parts have been produced in the equipment to date, and other divisions of the company are being informed of the machine's availability. New setups can be made for many different parts by resetting the cams, which control tool motions. Parts with widths up to 2½ in. or wire thicknesses to 3/16 in. can be most economically handled by the machine if lot sizes are over 25,000.

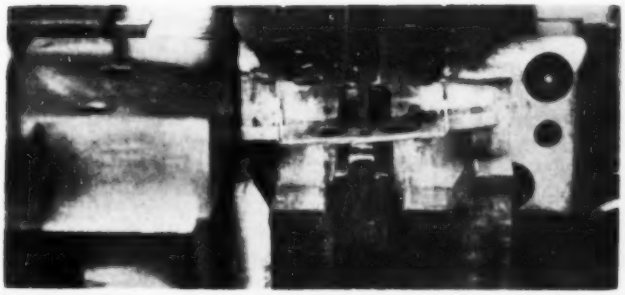


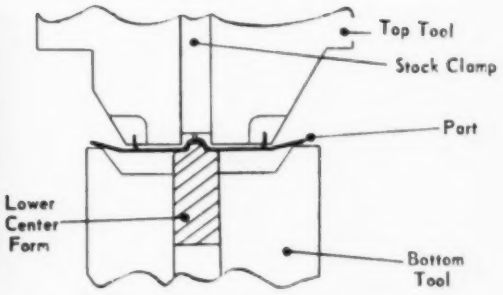
Verti-Slide is adjusted . . .
Cam angle is shifted to control upper center form, just above operator's hands

Enamel wiper die . . .
Stock is No. 7 hard phosphor bronze 0.021 in. thick and 0.5 in. wide. Final shape must be attained with critical tension between jaws. First operations on punch presses are 1—slit both sides, 2—blank out to leave tange, 3—pierce two large holes, one small, 4—bend up tangs

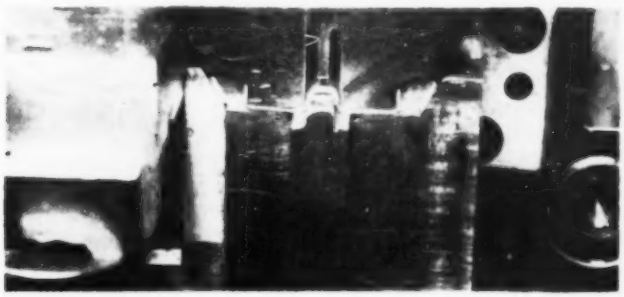


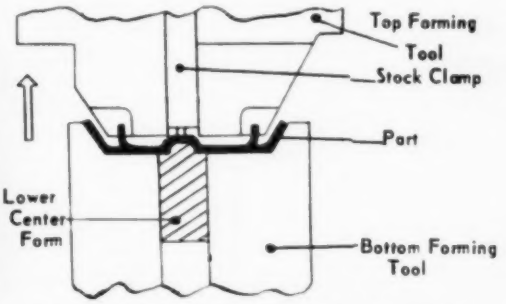
forms wiper dies at 65% saving



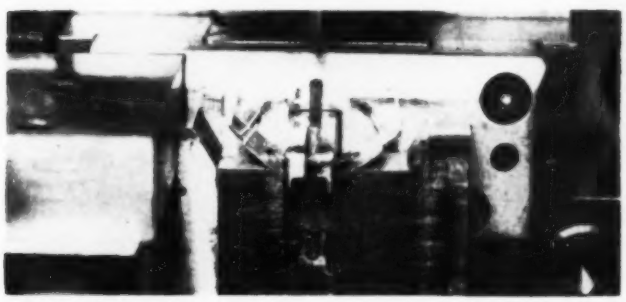


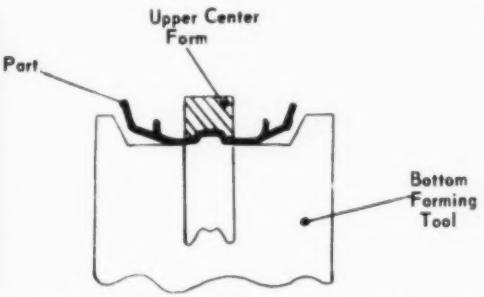
Stock feeds out . . .
First operation on four-slide machine is stop and cut off done as bottom tool feeds up against a die. Then upper tool comes down to start a bend around the lower center form



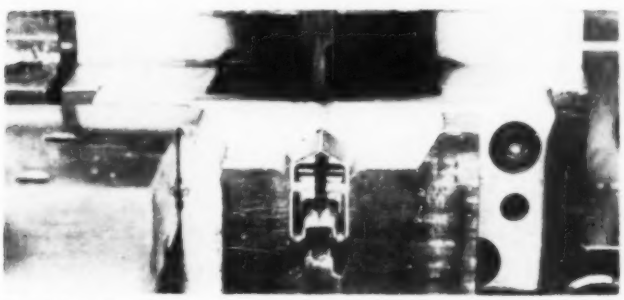


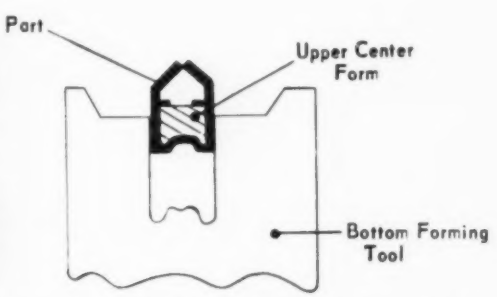
Bend is finished . . .
Bottom tool continues up to complete the center bend. Double bend action makes work flow freely. While work is clamped, the stock clamp descends to make a center slit





Tools withdraw . . .
Upper tool raises; lower center form withdraws. Bottom tool raises to start the reverse bend. Upper center form has replaced the stock clamp



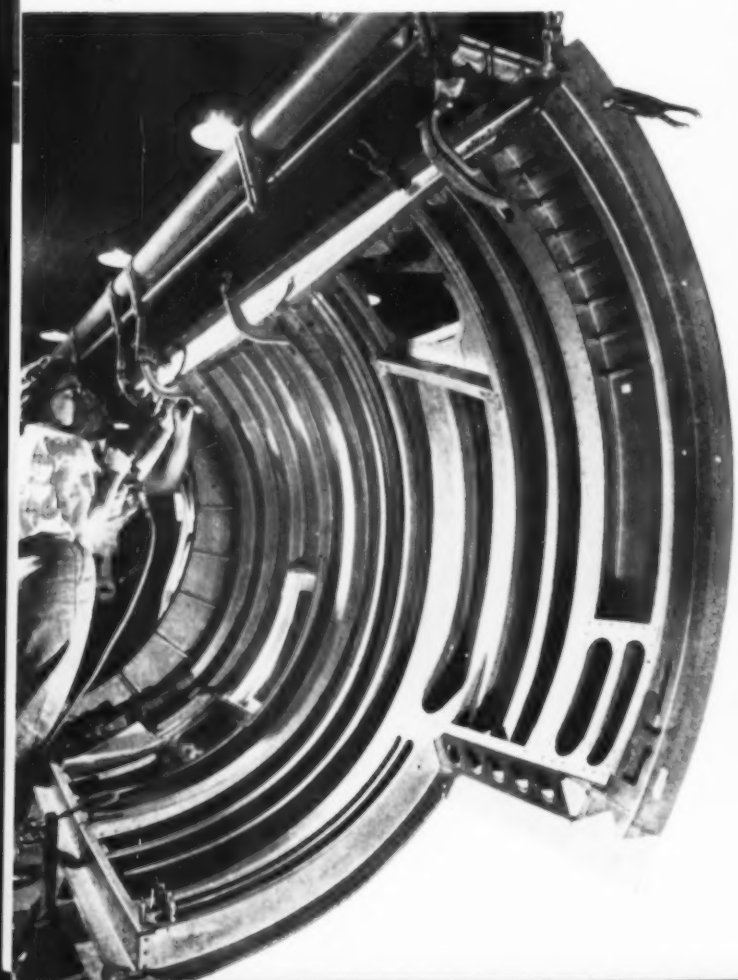


Final bend . . .
Part is finished as jaws are bent up to touch each other with exactly the required amount of pressure. Then bottom tool drops away, upper center form starts to withdraw, and part is stripped away (to fall clear) by lower center form as it starts back into work area

Titanium adds

United Air Lines' first commercial flight of the new Douglas DC-8 jet airliner on September 18 introduced the most significant use of titanium by a commercial carrier to date. Military planes have used titanium since 1950 for its light weight, strength, and corrosion resistance. Now the DC-8 includes 945 lb of fabricated parts in titanium (supplied by Titanium Metals Corp of America), most of them produced for Douglas by Ryan Aeronautical Corp, San Diego. This amount of titanium, says Douglas, is equivalent to five extra passengers and their luggage on each flight of the plane. The weight saving, according to United, is equal to

Titanium access doors . . .
are hung on engine pods, where they allow quick entry for servicing, or seal off completely any engine fire. Pods and pylons (which support pods from the wing) are fabricated with 600 lb of grade Ti 75A TMC titanium, made up into skin, ribs, channels, and other special shapes



Titanium rip stoppers . . .
are riveted to fuselage ribs over the stringers to add external strength without adding much weight. These are Ti-6Al-4V alloy, of which the plane uses 300 lb altogether

5 seats to DC-8 jet flights

a half ton of cargo—or an income of $525 at air-mail rates on a flight from coast to coast.

In spite of the high cost of the metal itself, advanced fabricating methods that are no more expensive than those for steel parts have been successfully applied. Techniques are similar to those for stainless steel. This makes total cost for the titanium parts little more than if they were made of steel.

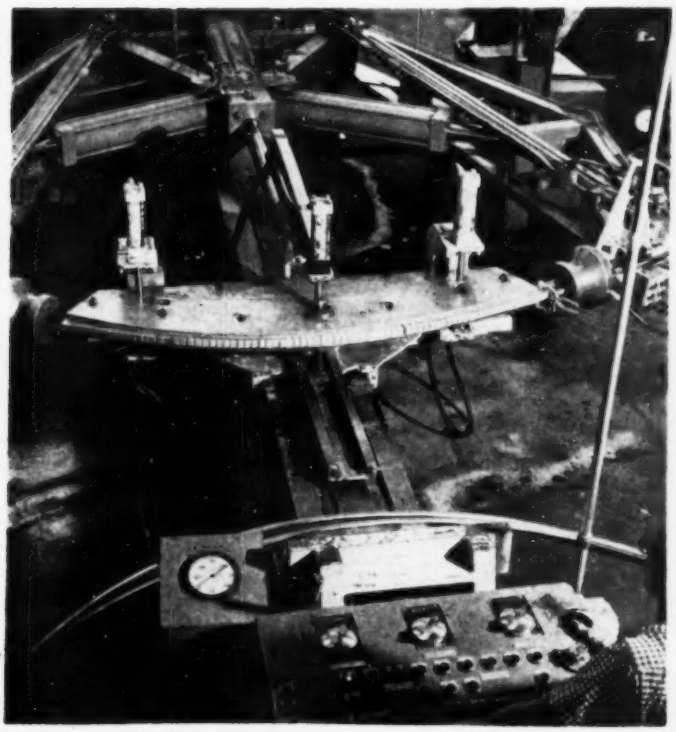
Hot-stretch forming, riveting, and welding are applied to 0.016-in. titanium sheet to produce access doors from three panels, each 36 x 72 in., to form up complete doors 104 x 76 in. Cumulative tolerances on length, width, curvature, and thickness are held to ±0.005 in., so all doors made to a given design are interchangeable.

Spotwelding is done at stainless-steel settings because titanium is similar in electrical and thermal conductivity. Adjacent surfaces are close together, and the weld cycle is of short duration; so special shielding is not required. Skins and supporting ribs for access doors are spotwelded together in special three-point-suspension fixtures that minimize distortion.

Holes must be drilled in titanium sheet for mechanical fasteners, particularly for the DC-8 pylon, which holds a jet-engine pod to the wing. These were originally drilled undersize and reamed by hand, but this technique was lengthy and expensive. A portable broaching tool was developed to bring hole diameters to size within 0.005 in. To keep all holes perpendicular to the stock, special plastic jigs were made to locate drill bushings against the work.

Eight special rules for drilling titanium have been developed at Ryan Aeronautical, where this work is being done:

1. One-shot, low-speed drilling is best because it minimizes titanium's tendency to workharden.
2. Shortest possible drill shanks must be applied.
3. Excessive drill travel after hole breakthrough must be eliminated because it may bellmouth or elongate the hole.
4. Core drilling must be done carefully because subsequent reaming removes only 0.0156 in. additional.
5. Upon breakthrough, stop motor immediately, turn reamer by hand in the cutting direction, and pull the reamer from the hole.
6. Cutting tools must be sharp, and pressure must be minimum at breakthrough; otherwise excessive burr will result.
7. Never trigger drill motors when working titanium because the stock will workharden.
8. Prove accuracy of tools only with a preliminary test hole.



Radial draw forming . . .
follows same steps as for a full-hard stainless steel. Access-panel rib is formed in 0.025-in. stock with segmented dies

Pylon skirts . . .
are protected from skin damage during shipment. Screw heads and fitted areas are masked, then skin is sprayed with plastic coating that is stripped off later

Positive rake... Negative rake...

Which rake

By **Horace Frommelt,** director, Metal Removal Center, Spring Garden Institute, Philadelphia

Positive-rake tools cut better—sometimes. And current cutting materials allow positive rake even when you're cutting 230,000-psi-tensile alloy steels. But positive rake angles also mean fewer cutting edges per insert, and often the economics can make negative rakes more practical, even when positive will work.

Negative rake is a hangover from the early days of carbides, when plain tungsten-carbide sintered compacts had too little transverse rupture strength to cut steel alloys without breaking. Even when additions of titanium and tantalum, introduced in the late 30's, improved carbide strength, the same negative angles had to be applied for high-strength alloys.

Conditions are different now. Steel can be cut with either positive or negative rake angles. But there is a big difference between the tools, both physically and economically.

The illustrated negative-rake tool is a square indexable carbide insert set in its own holder for negative-rake cutting. Every angle on the tool is a right angle. The insert is tilted 5° to produce 5° negative rake and also 5° clearance. The insert can be indexed around to present four edges, then inverted in the holder to present four more cutting edges.

This system won't work with the positive-rake tool, also illustrated. Positive rake demands less than 90° at the cutting edge, which automatically produces more than 90° at the bottom edge—so the tool can be indexed only four times before it is either discarded—or reground.

Result: A negative-rake insert has twice as many cutting edges as a positive insert. The inserts cost the same, so the negative insert will remove more metal per tooling dollar.

But "Which cutting angle is best?" is not that simple. The negative-rake tool is not an efficient cutting edge. Tests show that it will cut only 50-60% more parts than a positive-rake tool in spite of the fact that it has twice as many cutting edges. A negative insert develops tool pressures as much as 50% higher than positive-rake inserts, which may produce serious residual machining stresses. Furthermore, the blunter cutting edge requires more power for cutting.

The positive-rake tool, on the other hand, removes the same amount of metal at the same speeds, but does it with lower cutting forces. This reduces tool wear—and tests show that a positive-rake edge will cut about 25% more than a negative-rake edge. This means less frequent indexing and fewer times the machine must be stopped to allow tool indexing.

Tool Tests

Both kinds of tools have their best applications, where technical and economic factors prove one better than the other. To find out where advantage can be taken of the newer carbides, which will work with positive rake on high-strength alloys, a series of 12 tests was run to determine the performance of both kinds of edges under identical conditions. The results are tabulated.

A triangular insert was chosen for the tests, even though square inserts are equally common, pentagonal and disk inserts are sometimes applied, and hex inserts are often used for milling. The work material was SAE 4340 alloy steel heat treated to various hardnesses. Other test conditions were these:

Positive-rake tool: Carbide V-R 75. Triangular indexable blade (⅜-in. inscribed circle) precision ground with 5° positive top and back rakes. Cost $2.50.

Negative-rake tool: Carbide V-R 75. Triangular indexable blade (⅜-in. inscribed circle) mounted at 5° top and back rakes. Cost $2.50.

Work material: SAE 4340, diameter 4 in., length 12 in. Heat treated to several hardnesses ranging from 200 to 450 Bhn.

Cutting specifications: Depth of

COMPARATIVE TESTS — Cutting Efficiency of Positive and Negative Carbide Inserts

		RUN 1	RUN 2	RUN 3	RUN 4	RUN 5	RUN 6
Positive Angles Cut More Efficiently . . .		200 Bhn 550 sfm	250 Bhn 500 sfm	300 Bhn 450 sfm	350 Bhn 400 sfm	400 Bhn 350 sfm	450 Bhn 250 sfm
Parts Per Cutting Edge	POSITIVE	13.7	12.5	10.5	10	9	none
	NEGATIVE	10.5	9.5	8.5	8.0	7.2	5
Percent increase —	POSITIVE	21%	31.5%	23.5%	25%	25%	none
But Negative Angles Cut at Lower Tool Cost.							
Parts Per Cutting Tool	POSITIVE	40.1	37.5	31.5	30	27	—
	NEGATIVE	63	57	51	48	43	30
Percent increase —	NEGATIVE	57.5	54	59	53	60	—

angle for carbide inserts?

cut 0.125 in., feed 0.010 ipr. Cutting speed was reduced as hardness of work material was increased.

The tool cutting edge was considered worn when it reached 0.030 in. wear land, as observed through a toolmaker's microscope. The speed rates, same for positive and negative tools, were adjusted to yield an approximate tool life of 30 min with the positive tool.

Test machine: Monarch machinability lathe instrumented for cutting-force, temperature, and vibration measurements and recordings.

Test results: The positive-rake tool fractured when machining 450 Bhn steel, which sets an upper limit for positive rake at about 230,000 psi tensile strength.

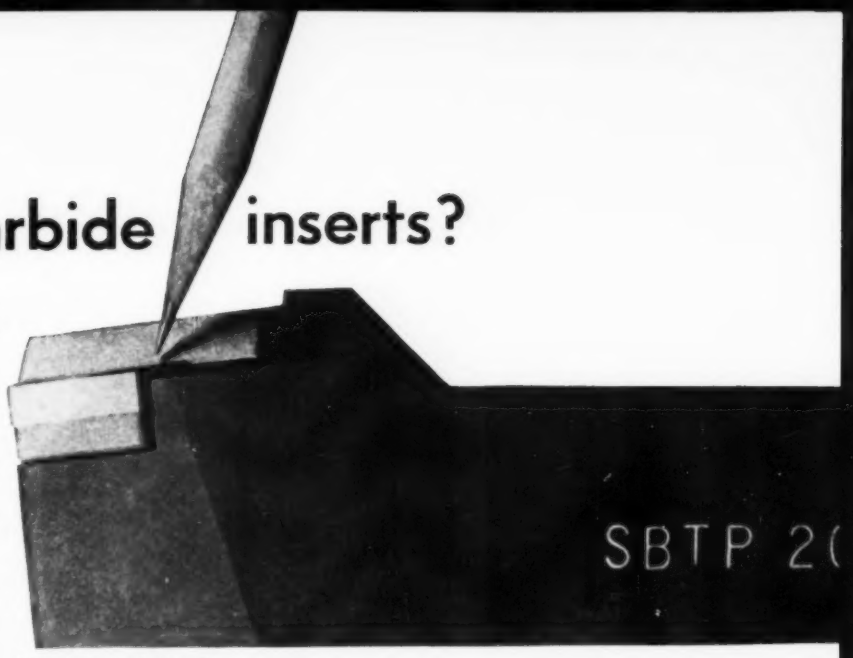
In spite of the fact that negative rakes are illogical, the tests showed that they will produce more parts at less cost on the basis of tool cost alone. Negative-rake production was shown to be around 60% higher than for positive-rake tools. But the more efficient positive-rake tools *did* produce about 25% more parts/edge.

Rules of thumb? No pat rules can be laid down for selecting one angle or the other. For example, although it is probably best for positive angles to be applied when cutting non-ferrous metals, recent tests have shown that negative angles may be better on some common aluminum alloys and other non-ferrous metals.

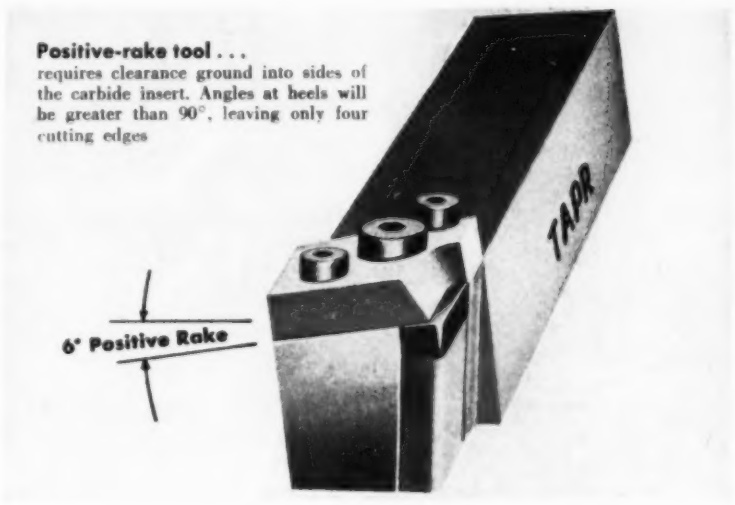
It has been said that positive angles should always be applied for cutting cast iron. But this choice is open to question, even when the iron is controlled, like Meehanite, with hardness of 200 Bhn or higher.

Positive rake has also been recommended for stainless, particularly austinitic or work-hardening alloys. But a large stainless-steel forging was milled in a recent test with a negative-rake tool that proved to be more economical when applied with lower tooth loads and higher speeds.

Surface finishes are also affected by rake angles. In some cases the negative rake results in cutting forces too severe to produce an acceptable finish.



Negative-rake tool . . .
has right-angle geometry, which provides automatic clearance angles at all corners. Insert may be reversed for a total of eight cutting edges



Positive-rake tool . . .
requires clearance ground into sides of the carbide insert. Angles at heels will be greater than 90°, leaving only four cutting edges

Putting the Results to Work

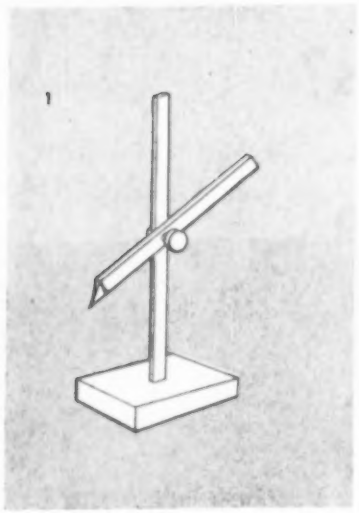
There is no best solution to any production problem—only a better one than the last. For shop use, the results of these tests should be weighed against the total production picture for the individual plant. Other factors should be considered: labor rate, tool-change time, production speed, and overhead. There must be compromise before there is a solution.

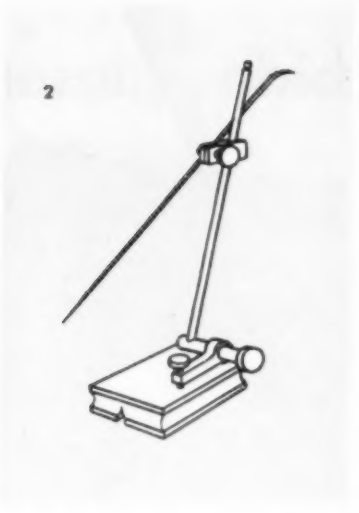
Some points can be made from the results of these tests, bearing in mind that they take into consideration *only* tool cost:

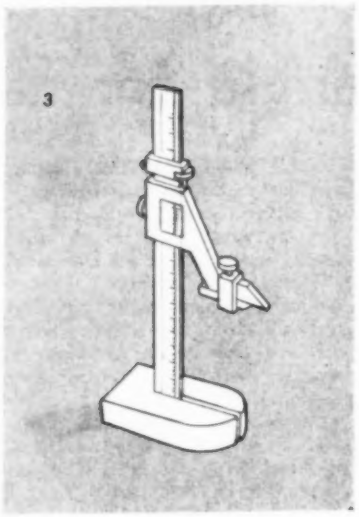
- Carbide inserts with positive rake can now successfully cut steel alloys up to 230,000-psi tensile strength.
- Positive rake has its place for steel alloys when high cutting pressures from negative rake would distort the work or produce a poor surface finish. This is most likely to occur on work with thin sections.
- Negative rake angles, though technically illogical, should be specified for the most economy.
- Negative-rake geometry is necessary for steels with tensile strengths over 230,000 psi.

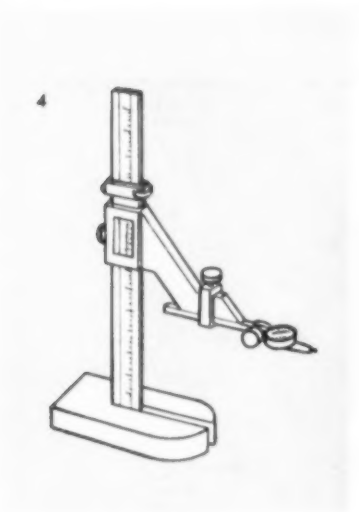
In the Future

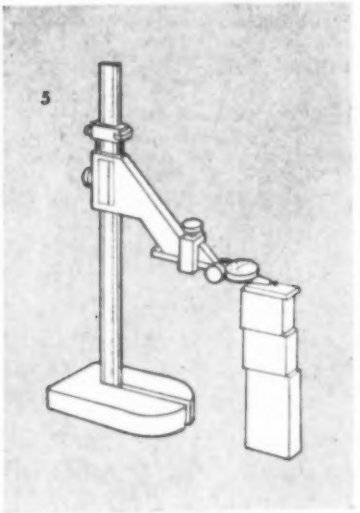
Positive-rake tools will now do jobs considered impossible for them in the past. Positive rake angles should improve future cutting efficiency—higher cutting speeds, lower cost/part. Longer life for positive-rake tools may prove advantageous. And as insert regrinding becomes more common, positive rakes may become more economical.







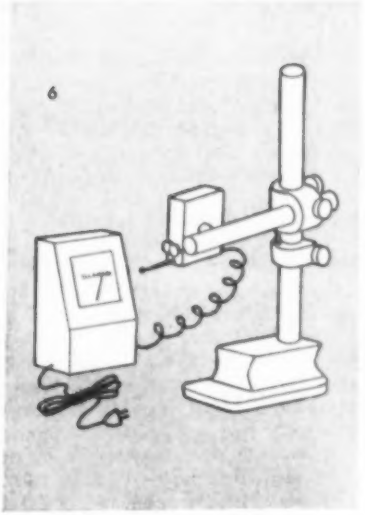


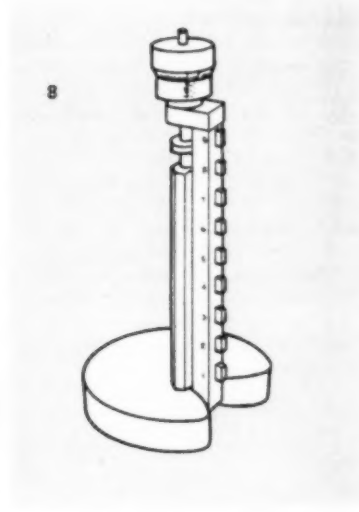


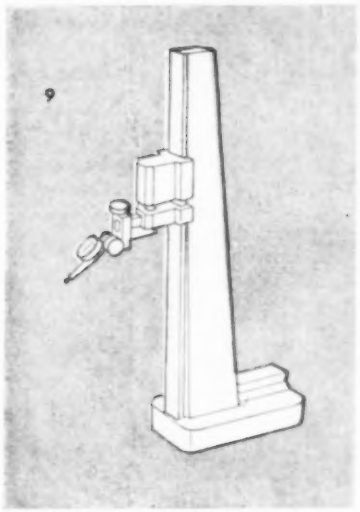
HEIGHT

By William T Nystrom,
Precision Tool & Gage Group,
Brown & Sharpe Mfg. Co,
Providence, R I

How well do you know what has been going on in the height-measuring field? Here is a run-down of developments to show that this type of measurement has caught up with other methods of gaging



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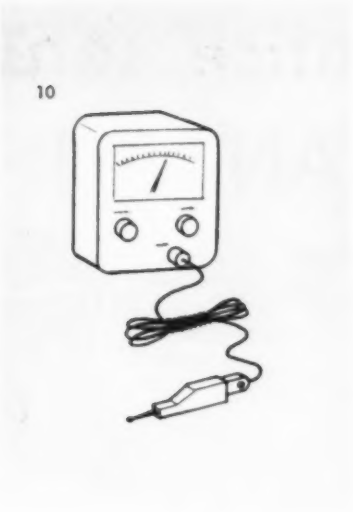
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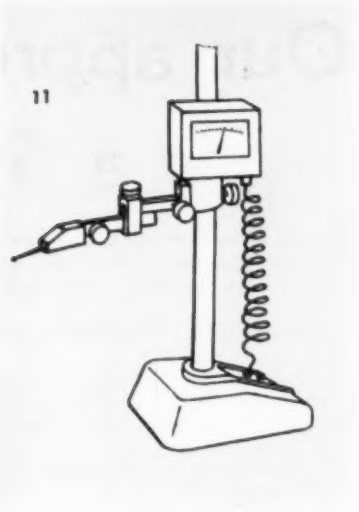
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MEASUREMENT comes of age

An orderly transition has taken place recently in the height-measuring field. Things started to move in the Thirties; old concepts were superseded in the middle Fifties. Now we can use height gaging for high-magnification comparison.

So many of us still use older methods that it is worthwhile to review what has been accomplished.

Earliest measurement of height used the obvious crossed sticks (1) on a base. Next came the surface gage (2). The first real measuring device of any accuracy was the vernier height gage (3).

At this point there was a long period of inactivity while the needs of Metalworking caught up with and passed capabilities offered by the vernier height gage. The only advance during this era was the addition of the dial indicator (4). This development removed the influence of "feel," and introduced the need for a master setting device, which tended to take the form of gage blocks (5).

Electrical Pickups

During the latter part of this era (the late 1930's), the electrical height pickups (6) were explored. These new devices sharply increased the magnifications available, eliminated undesirable friction, but had other limitations. They did not reach the level of magnifications really necessary, generally had substantial low-frequency vibrations, and their high measuring pressures tended to distort slender work. Also, the available stands lacked stability.

Next, the electronic height pickup (7) was introduced and superseded the electrical device. It had high magnification, low gaging pressures, no vibration, and excellent repeatability with no friction. It did, however, need an external power source and connections, which were a deterrent to speedy measurement by the toolmaker. Also, the remote indicating meter made the user look at two devices as nearly simultaneously as he could.

However, during development of the electric and electronic devices, the vernier height gage with dial indicator continued to be, by far, the most widely used device. On many occasions this was true, because of facility of usage, *long after the accuracy provided by the combination was inadequate.*

Progress on two important phases associated with height measurement was not made until the late 1940's. The reference master, now becoming vital because the pickup elements have no basic in-built measuring capacity, had not progressed beyond the gage block. The carry stand remained in the form of the vernier height gage or a round post in a heavy base.

Gage blocks, while affording accuracy were costly and cumbersome to use on larger heights. Developments in this area led to the "adjustable master" (8), which, in effect, was either a stepped spindle with basic in-built step accuracy, with a micrometer adjustment, or a series of blocks positioned together with step accuracy and a micrometer adjustment. This development afforded much greater speed in settings to any height. Emergence of extremely accurate riser blocks projected the new height setting tools to unlimited heights.

Adequate gage-head carrying stands (9) were designed in the middle 1950's to eliminate shake and chatter. This was done by putting the weight into the base and constructing the upright in the form of an aluminum box, tapered to the top.

Transistor Applied

Most recently, the transistor (10) has come into play as the high-magnification comparator. The transistor can be supplied by local battery sources. Thus, the gaging head and indicating meter can be more intimately coupled. All the requirements of high magnification, low measuring pressure, no friction, no vibration are met. It only remained for the combination to be built into a single device as in (11).

What of the more conventional tools while this development work has gone on? The height gage, dial indicators, and gage blocks have continued to find wide utility. The vernier height gage is considered practical for medium tolerances.

Our apprentice setup is a SCANDAL!

Owners of contract tool and die shops will tell you that skilled men are their "most precious possession," BUT:

- On an industry-wide basis, 43% of shops are unable to hire sufficient craftsmen who meet their standards, even though the industry has not yet fully recovered from the recession.
- There are only 3000 apprentices in 2434 shops employing 34,000 persons accepted as journeymen.
- 58% of these shops are not training apprentices.
- The industry as a whole is training only 60% as many apprentices as will be needed to replace journeymen who will die or retire in the next five years.
- Skill levels of the journeymen group do not correspond with the real needs of the industry, as exposed by the current analysis of apprenticeship training. For example, of the 34,000 journeymen now employed, 32.6% are rated as "tool and die maker," and 30.5% as "machinist," whereas in the apprentice group, 55.1% started at least as "tool and diemaker" and only 17.4% fall into the "machinist" category.

Warning is plain

How does this situation stack up against what industry spokesmen have been saying about maintaining and increasing the pool of skilled manpower?

In *AM* Special Report No. 385, "Train Diemakers—or Die!", Jack Kleinoder, then chairman of the Apprenticeship Committee of the National Tool & Die Manufacturers Assn, said:

"To put the tool and die industry on its feet, the NTDMA estimates that about 8000 apprentices must begin training each year.

"Tooling needs will be 50% greater in 1970—how can you meet demand with too few craftsmen?"

Concern for the future prompted the NTDMA to request that a national survey of skilled manpower and apprenticeship be taken among all contract tool and die shops in the country. This work was undertaken by the Bureau of Apprenticeship and Training, U S Dept of Labor. Field representatives of the Bureau and of state apprenticeship agencies, along with local NTDMA people, visited 2434 contract tool and die shops in 33 states—all of the tooling centers in the country, except California, which was unable to participate in the study.

The study was conducted during January-June, 1959, a period which certainly was not one of boom conditions. Total employment was 119,000 people. Skilled personnel, at 34,000, represented only 28.6% of the total. Apprentices at 3000 amounted to only 2.5% of the industry workforce.

Although the first half of 1959 was a period of substantial unemployment in the contract tool and die industry, the availability of qualified skilled personnel was extremely spotty in the various tooling areas.

In New England, for example, only 20% of the shops could get people of the type they wanted. In New York, 84% of the shops could find desirable workers, but in New Jersey only 16% found a sufficient supply. New Jersey has experienced a considerable growth in electronics.

In Pennsylvania and Ohio, 62% of shops could get qualified personnel: in Michigan, shops could get 83% because of slackened tooling activity in the auto industry. The overall national average was 53%.

The figures tend to show that shops with apprenticeship training are more choosy as to the type of people they will hire.

What of the future?

Shop owners will hang onto their best men to the bitter end. It follows that many of the men now available on the market are those with the least ability or training, or both. Any significant improvement in tooling activity will put these men back to work. If the Roaring Sixties pan out as the economists say, apprentice training as it exists now will be inadequate to fill the gap. And because skilled men today are not as prone to migrate as the old-time "boomer" was, many shops will be unable to build organizations to cope with demand for their services.

Only 42% of contract tool and die shops are attempting to maintain, let alone increase, their skill inventory through apprentice training. These firms employ 59% of the journeymen in the industry. The smaller the shop, the higher the ratio of apprentices. For enterprises of 10 men or less, the

Recommended: 8000 apprentices in training every year

Actuality: 2911 apprentices in various stages of training in 1959

Employees per shop	Number of shops	Employees	Journeymen	Apprentices	Journeymen per apprentice
Less than 10	763	4033	2838	286	9.9
10 to 19	575	7879	4791	434	11.0
20 to 49	586	18,065	9746	728	13.4
50 to 99	209	13,813	5966	497	12.0
100 or more	208	71,869	9208	812	11.3
Number unknown	93	3027	1281	154	8.3
TOTAL	2434	118,686	33,830	2911	11.6

ratio of journeymen to apprentices is 3.1 to 1, and for large shops, those with 100 people or more, the ratio is 8 to 1. The average is 6.9 to 1.

These firms are training 99% of their own replacements, as needed by reason of death and retirement in the next five years, but they are doing nothing to allow for expansion, and nothing to help out the remainder of the industry.

It is the 1390 "non-doer" shops, which are placing the industry in a critical position relative to skilled manpower needed in the years ahead. These shops employ 14,000 men. If they were to adopt apprenticeship, take on one apprentice for every seven journeymen, the ranks of apprenticeship would be swelled by 2000, making a total of 5000.

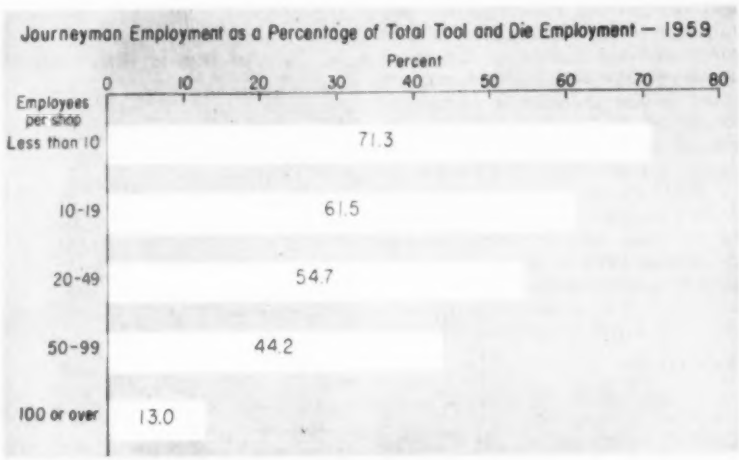
Right away, we see that NTDMA's warning in 1955 was not "pie in the sky" thinking. That organization advocated training 8000 apprentices to cope with drop-outs and the expected expansion in need for tooling services, as Metalworking advances with the times.

Drop-out problem

If all contract tool and die shops were to adopt and adhere to a policy of training one apprentice for every seven journeymen, the replacement of journeymen drop-outs might be solved. However, there is one factor that must not be overlooked. That is drop-outs of apprentices.

The Bureau of Apprenticeship and Training made a study in 1947, which indicated that only 65% of apprentices complete their training. The current study shows that about 90% of the 568 apprentices who should graduate this year will do so. But what about 1963, when only 219 are scheduled to reach journeyman sta-

Only apprenticeship can fill the constantly increasing need for journeymen, particularly in the small-to-medium shop . . .



. . . yet even in shops with apprentice training (42% of total) there is an average of 6.9 journeymen to one apprentice . . .

Employees per shop	Journeymen	Apprentices	Journeymen per apprentice
Less than 10	866	281	3.1
10 to 19	2077	435	4.8
20 to 49	5535	727	7.6
50 to 99	3881	491	7.9
Over 100	6629	824	8.0
Number unknown	999	153	6.5
TOTAL	19,987	2911	6.9

tus? According to statistics, it is likely that young men entering the trade in 1963 will cover only 22% of the losses in that year by reason of death and retirement.

The figures compiled by the Bureau of Apprenticeship Training are valuable for another reason—they disclose the skills of the present body of journeymen and the kind of training that apprentices are being given by the 1000 shops that go to the trouble of providing training.

Obviously, the managements concerned are well aware that a higher degree of skill is necessary for future journeymen than was the case a few years ago. Employees with the status of "tool and diemaker" comprise only 32.6% of the present skilled category, whereas 55% of apprentices are headed toward this status.

Division of skills

For many years, tool and die shops have attempted to utilize unskilled and semi-skilled personnel for certain operations. This practice is even more prevalent among the large shops. Nearly 70% of total employment in the industry is outside of the journeyman or apprentice categories. If we leave out management, clerks, designers, etc, the lion's share of employment is still outside of skilled status. It would seem unlikely that any further subdivision or dilution of skills is likely to be practical, considering the growing complexity and technical level of tooling for industry and the services.

Recruitment

Nearly 15% of firms training apprentices report that they utilized their own semi-skilled and unskilled labor force as a recruiting ground. The remaining shops enlisted sons of employees or advertised.

A large percentage of supplementary classroom instruction is being obtained by cooperation with trade and technical schools. Over 70% of firms conduct over 100 hr of classwork per yr. Eight percent of the firms provided in excess of 200 hr of instruction outside of the toolroom per year.

Question of survival

The figures show that the 52% of shops who have no apprenticeship also tend toward a lower level of skill. When the Bureau's investigators were making their rounds, they found that 160 shops were "out of business." How many of these had no apprenticeship, we do not of course know.

Number of tool and die journeymen (by trade) today . . .

	Toolmaker	Diemaker	Tool and diemaker	Impression die sinker	Trimmer die sinker	Machinist	Mold maker	Other
SHOPS WITHOUT APPRENTICES								
Total employees 13,843	939	2060	3790	119	28	4886	489	1530
% of total	6.8%	14.9	27.4	0.9	0.2	35.3	3.5	11.0
SHOPS WITH APPRENTICES								
Total employees 19,987	2524	2101	7195	157	73	5464	837	1636
% of total	12.6%	10.5	36.0	0.8	0.4	27.3	4.2	8.2
Grand total employees 33,830	3463	4161	10,985	276	101	10,352	1326	3166

. . . and this is the number of apprentices (by trade) and the year they will become journeymen . . .

	All trades	Toolmaker	Diemaker	Tool and diemaker	Impression die sinker	Trimmer die sinker	Machinist	Mold maker	Other
1959	568	56	51	313	5	3	81	37	22
1960	837	74	74	477	10	4	144	30	24
1961	818	70	73	440	8	4	160	45	18
1962	469	47	41	263	8	1	84	21	4
1963	219	14	28	111	5	2	38	14	7
Total in training	2911	261	267	1604	36	14	507	147	75

This is the age breakdown by trade of journeymen . . .

Age group	Toolmaker	Diemaker	Tool and diemaker	Impression die sinker	Trimmer die sinker	Machinist	Mold maker	Other	All trades
Under 35	795	1025	3173	71	20	2725	468	862	9150
35 to 54	2145	2475	6338	169	64	6195	702	1948	20,036
55 to 64	467	563	1243	30	13	1255	130	319	4020
65 and over	56	87	231	6	4	177	26	37	624
ALL AGES	3463	4161	10,985	276	101	10,352	1326	3166	33,830

. . . from which it is evident that over the next five years there will be far too few apprentices to replace men approaching or over retirement age

Production man's guide to

Lubricants for machine tools

Like your automobile, a machine tool gives its best service if properly lubricated. But the lubrication of machine tools is a more complicated matter by far. To aid you in maintaining output and avoiding wear and breakdowns, a detailed study has been made of lubricant recommendations for all of the mechanisms in all types of machine tools. This information is charted for you; likewise the lubrication of electric motors. To round out the subject, the basic factors in lubrication of machinery are reviewed

By B M Dunham, technical consultant, Sun Oil Co, Philadelphia

Efficient lubrication of bearings, gears, and other moving parts of machine tools depends on a balance among several factors. Choice and performance of a lubricant are influenced by design, lubrication method, temperature, surface speed, load or pressure, clearance and other operating conditions such as the possibility of contamination of the lubricant by outside impurities.

While meeting the infinite variety of conditions imposed by combinations of the above factors, a lubricant must perform the following functions:

1. Maintain an unbroken film between metal surfaces to prevent excessive wear.
2. Prevent excessive friction and consequent heat, harmful to both equipment and lubricant and sometimes to maintenance of product size.
3. Absorb and carry away heat normally generated between moving surfaces and keep operating temperatures as low as possible.
4. Must be stable, maintaining its properties within allowable limits under severe operating conditions.
5. Must be economical.

Temperature vs. Viscosity

Viscosity is the most important characteristic of a lubricant at work. Because viscosity varies with temperature, the important factor is the viscosity of the oil within the temperature range encountered by the machine in operation, not at room temperature. An oil that thins out too much at high temperatures will not maintain a safe film. If high temperatures are unavoidable, a higher viscosity oil should be specified to deliver optimum lubrication. On the other hand, winter temperatures require low-viscosity, low-pour-point oils which will maintain fluidity and prevent thickening to the point of being inefficient.

Load vs Viscosity

Light loads require oils of lower viscosities than heavy loads, not only because of the lower pressures between bearing surfaces, but because lightly loaded mechanisms frequently receive less power. Excessive drag of a high-viscosity oil absorbs too much of the available power. On the other hand, where a bearing or gear set is overloaded and the lubricant is overtaxed, a special study by a competent lubrication engineer should be made.

Another form of overloading is caused by inaccurate fits and misalignment. Highly localized overloads, confined to small but critical areas of machine parts, can cause overheating of metals and oil.

Speeds, Clearances, and Types of Motion

Speeds influence the selection of an oil. Higher surface speeds require light oils with sufficient adhesiveness to keep them on the lubricated surfaces despite centrifugal force.

High-speed operations also require relatively rapid delivery to bearings or gears. Lighter oils are easier to pump and to pipe, and can get into small spaces more quickly than the thicker, heavier oils.

In general, bearings and gears should be operated at the lowest possible temperature and lubricated with oil of the lowest viscosity suitable to the operating temperature and other conditions.

In bearings, clearance influences the choice of an oil. Clearance between moving surfaces is governed by surface speed; that is, the speed of rotation in relation to shaft diameter. High journal speeds demand close clearances and light or low-viscosity oils. Low speeds permit wider clearances and heavier, high-viscosity oils.

Clearances tend to increase with wear of moving parts. Thus, clearances between parts operating at high speeds may eventually resemble clearances normally specified for low-speed machine elements. When this condition develops, people who lubricate these older machines are tempted to apply higher-viscosity oils. It is usually sounder practice to change to oils of comparable viscosities but containing an adhesive or tackiness agent, or to replace the worn parts.

The type of motion of the bearing may also affect the formation of the oil film. The lubrication problem may become serious in the case of intermittent or reciprocating motion, frequently encountered in guide bearings,

Table I—Significant Requirements of Plant Lubricants

GENERAL LUBRICATION

- Viscosity
- Film strength
- Metal protection

HYDRAULICS & CIRCULATING SYSTEMS

- Viscosity
- Oxidation stability
- Anti-wear properties
- Anti-rust properties
- Anti-corrosion properties
- Water separation
- Anti-foam properties
- *Fire-resistance
- *Pour point
- *Viscosity index
- *Cleansing action
- *Anti-leak properties

GEAR BOXES

- Viscosity
- Oxidation stability
- Film strength
- Anti-rust properties
- Anti-corrosion properties
- Anti-foam properties

MACHINE TOOL WAYS

- Viscosity
- Extreme-pressure characteristics
- Oiliness
- Anti-rust properties
- Anti-corrosion properties

MACHINE TOOL SPINDLES

- Viscosity
- Oxidation stability
- Anti-rust properties
- Anti-corrosion properties
- Film strength
- *Cleansing action

GREASE LUBRICATION

- Pumpability
- Water resistance
- Oxidation stability
- Mechanical stability
- Anti-rust properties

* Special consideration dependent upon operating conditions

Table II—Applications f of Various Vis

Lubricating Oil Viscosity (SSU @ 100 F)	
100	High mach rpm)
150	Gen lics, ators chin lubri
300	Gen moto rpm) air boxe
500	Gen moto pres
750 to 1000	Gea ings, gear ings,

or in cases where the direction of rotation is reversed. Such cases require careful study in order to select the most suitable lubricant and method of application.

Other conditions affecting lubrication are due to outside sources. These include the surrounding temperature, heat produced within the bearing due to characteristics of the bearing metals, presence of moisture, abrasive dust or other contaminants in the surrounding atmosphere, and possible dilution of the oil by cutting fluids or other liquids.

Greases

Greases are frequently employed for the lubrication of machinery parts that are difficult to reach during operation.

The characteristics of greases make them especially suitable for lubrication of gears and bearings under specific conditions:

1. Heavy loads and slow speeds.
2. At high temperatures at which an oil would thin excessively and leak out.
3. In dusty atmosphere, where the grease may also act as a seal and protect the metal surfaces against infiltration of and damage by abrasive impurities.
4. Where bearings reverse or operate intermittently.
5. Where clearances are excessive due to wear.

The most important characteristics to be considered when selecting a grease for a specific application are the viscosity of the mineral oil and type of soap used in its preparation, and the consistency of the grease. The consistency is controlled by the soap content. If the consistency is too low, the grease will leak from the housing. When the consistency is too high, channeling may occur, or there may be excessive internal friction with consequent overheating.

Greases should be free from particles of solid or abrasive matter or fillers, which may cause wear.

As a rule, low speeds and temperatures require a softer grease than do heavier operating conditions.

In selecting a grease, the consistency must be suitable for the method of application. Greases applied by grease guns or high-pressure systems must be sufficiently soft so that they can be handled effectively. Grease cups or handpacked bearings can be filled with harder greases.

Types of Greases

Prior to the introduction of "multi-purpose" greases, two types of grease were in common use: calcium—or lime-base (water-resistant, low-temperature) and sodium—or soda-base (moisture-absorbing, heat-resistant). These greases are still frequently used where expense is a prime consideration.

ons for Lubricating Oils us Viscosities

Application
High-speed bearings, high-speed gears, machine tool spindles (5000 to 8000 rpm), quenching oil, hydraulics
General-purpose, gearboxes, hydraulics, spindles, electric motors, generators and fans (under 1800 rpm), machine tool circulating systems, air-line lubricators, quenching oil, air filters
General-purpose, hydraulics, electric motors, generators and fans (over 1800 rpm), machine tool automatic systems, air compressors, vacuum pumps, gearboxes
General purpose, gearboxes, geared motor-generator sets, hydraulics, compressors, press lubricant
Gearboxes, high-temperature bearings, hydraulics, general-purpose oil, gear motors and reducers, pump bearings, press lubricant

Table III—General Recommendations for Lubrication of Machine Tools

Parts to be Lubricated	Grade Approx. Viscosity, SSU @ 100 F
Machine, general hand, mechanical, splash or circulating systems:	
Low viscosity	150-200
Medium viscosity	300
High viscosity	500
GEARS (INCLOSED)	
Light duty	500 to 900 (SAE 90)
Heavy duty (including worm gears)	2500 (SAE 140) E.P.
HYDRAULIC SYSTEMS	
Low viscosity	150
Medium viscosity	300
SPINDLES	
High speed (oil)	50-150
Low speed (oil)	100-300
Grease lubricated	N.L.G.I. No. 1
WAYS	
Average loading	300 to 400 (Special oiliness and E.P. qualities)
Abnormal loading	1000 (Special oiliness and E.P. qualities)
GREASE LUBRICATION	
Normal temperatures	Lime-base grease N.L.G.I. No. 1
High temperatures	Soda-base or lithium-base grease N.L.G.I. No. 2

Lithium-base greases, developed during World War II, provide most of the desirable characteristics of both calcium- and sodium-base greases. They are water-resistant, heat-resistant, and are suitable for "multi-purpose" use.

Comparative Advantages of Oil and Grease

In general, oil is easier to handle in draining and refilling operations, and the correct amount of oil is more readily controlled.

Oil finds a wider application in the lubrication of all parts of a machine and is more suitable for lubrication at subnormal and at higher temperatures and operating speeds.

Oils offer a wider range of viscosities to choose from for a wider range in speeds and bearing loads.

If heating or cooling of the lubricant is necessary, it can be done by means of oil circulation or cooling systems.

Oil lubrication for certain types of machinery, such as fully inclosed electric motors, operating continuously under severe working conditions, furnishes a safer, more easily controlled method of lubrication than grease lubrication.

Grease can be more easily confined in a bearing housing than oil. Special design to prevent leakage is unnecessary. A housing filled with grease requires less attention to the quantity present than is the case if oil is used.

In certain designs and operating conditions, grease will provide a better bearing seal and protection against infiltration of foreign matter, such as moisture, dirt and abrasive material, than oil.

Lubrication Chart

Table IV is a guide for lubrication of the major types of machine tools. To find the recommended lubricant for a certain application, first locate the machine at the top of the page, then moving down that column, locate the particular machine part in the column at left. The number shown indicates the suggested viscosity range of the lubricating oils in Saybolt Universal Seconds (SSU) at 100 F. General recommendations for other machine tool parts are found in a similar manner.

Example: If the machine is an engine lathe, and the part to be lubricated is the headstock, in the "Engine Lathe" column, corresponding to the description "Headstock" at the left, is the figure 300-500, which indicates that the major manufacturers of the various engine lathes recommend oils of viscosities ranging from 300 to 500 SSU @ 100 F.

Where special oils or greases are recommended, these

Table IV—Guide to

Numbers Under the Various Machine Tools and Opposite Ea

Machine Part	Engine Lathes	Turret Lathes	Automatic Screw Mach.	Milling Machines	Thread Grinders
Main Drive Gearbox			200-300	200-300	
Headstock	300-500	150-300	200-300	200-300	300-500
Speed-Change Gearbox	300-500	150-300	200-300		300-500
Tailstock	300-500	150-300			
Feed Gearbox	300-500	150-300		200-300	
Rapid Traverse Gearbox		140 EP		140 EP	140 EP
Worm Gears			140 EP	140 EP	140 EP
Column Gearbox				200-300	
Quill					
Spindle	300	200-300	150-300	100-300 or G	50-300
Apron	W	W	W		
Carriage	W	W	W		
Ways	W	W	W	W	W
Wheelhead & Slide					300
Hydraulics			150	150	
Knee				200-300	
Ram				200-300	
Column				200-300	
Arbor				200-300	
Elevating Screw				300-or W	
Elevating Mechanism					
Lead or Feed Screw	W	W		W	W
General Lubr.					
Oil	300-500	200-500	300-500	200-300	300-500
Grease	G	G	G	G	G
Electric Mtrs.	See Separate Table				

CODE

90 EP — An SAE 90 mild non-corrosive extreme pressu
140 EP — An SAE 140 mild non-corrosive extreme press
W — An SAE 80 type way lubricant having a vis
GS — A semi-fluid grease for gearboxes on drilling
G — A general-purpose grease
M — A combination hydraulic and way oil (150

are indicated by code designations such as 90 EP or GS, etc., which are explained in footnotes.

In compiling the viscosity limits for each machine tool category, a detailed study was made of the recommendations of each of the major builders. The limits selected for the chart represent the minimum and maximum viscosities stipulated. Of course, exceptions to these limits were designated by one or more manufacturers in each category.

Some viscosity limits appear to be quite wide. For example, the table stipulates 150 to 500 SSU for main-drive gearboxes of boring mills. This means that so builders recommend 150 SSU @ 100 F, others, 500 SS If any doubt exists as to the exact viscosity of oils unit parts, the manufacturers' recommendations sho be followed.

Oil-viscosity recommendations for machine-tool sp dles vary widely. Again manufacturers' data should used. These differences result from variables such type of bearing, speed, clearances and method of application. In general, the viscosities used for the va ous application methods are:

e to Selection of Lubricants for Machine Tools

te Each Machine Tool Part Refer to the Proper Viscosity Range of the Lubricating O

read nders	Grinding Machines	Drilling, Tapping or Threading Machines	Radial Drilling Machines	Horiz. & Vert. Broaches	Boring Mills	Hobbing Machines	Planers
		150-300			150-500	300	100-500
-500	150-200	150-300	300		150-500	300	
-500		150-300 or GS	300		150-500	300-500	
	150-200	150-300 or GS			150-500	300	100-500
EP	140 EP	140 EP			140 EP		140 EP
EP	90 or 140 EP	140 EP	140 EP		140 EP	140 EP	140 EP
			140 EP		150-300		
		300 or G	300 or G	300 or G	100		
-300	30-300 or G	50-300 or G	300 or G	60	100-500	300 or G	300
	W	W	W or 300	W (SAE 90)	W	W	
	50-500 or G	300					
	150-300 or M	150-300	150-300	150	150-300	300	300
			140 EP				300
			140 EP		W or 140 EP	300	140 EP
			140 EP				140 EP
	W or 300	W			W or G	W or EP 90	140 EP
-500	200-500	300-500	300	200-500	300-500	300-500	100-500
	G	G	G	G	G	G	G

e pressure oil
me pressure oil
ing a viscosity range of 300 to 350 SSU at 100 F, and having oiliness and extreme pressure characteristics
n drilling machines

oil (150 to 300 SSU at 100 F for use in grinders where a low pressure feed from the hydraulic system feeds the ways

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Method	Viscosity @ 100 F	Speed Range
Circulating system	36 to 300	High
Ring oilers	200 to 300	Low
Sight feed or wick feed oilers	100 to 200	Low
Mist applicators	55 to 150	High

Greases are also specified for some designs of machine tool spindles where contaminants may be present, where leakage is a factor, and for anti-friction bearings.

Some users prefer a dual- or triple-purpose oil f cutting, lubricating and/or hydraulics on automat screw machines. Such an oil is light in color, has hig lubricating value and non-staining properties, and ran es in viscosity from 100 to 175 SSU @ 100 F.

Mild, non-corrosive, extreme-pressure oils are recom mended for the heavier-duty applications. These a listed as 90 EP, 140 EP, and W. If it is found desirable necessary to utilize extreme-pressure oils for applic tions where straight mineral oils have been found lac ing, use one of the same viscosity.

ils at 100 F

Shapers	Honing Machines
300	150
300	
	140 EP
	150 or G
300 or W	W
300	150-300
140 EP	
140 EP	
300	150-300
G	G

Table V—Lubrication of Electric Motors

Application Method	Speeds Under 1500 Rpm	Speeds 1500 Rpm and Over
	Oil Lubrication, Viscosity, SSU @ 100 F	
Pressure Lubrication	150-500	100-200
Oil Level System	150-500	100-200
Wick Feed	300-500	150-300
Spray Feed (Slinger)	200-500	100-200
Oil Ring	300-500	150-300
Waste Packed	300-500	150-300
	Grease Lubrication At Any Speed	
Pressure Gun		NLGI No. 2 Grease
Packed		NLGI No. 2 Grease
Grease Cups		NLGI No. 2 Grease

Table VI—Relubrication Periods For Motors With Anti-friction Bearings

Horsepower of Motor	Conditions		
	Standard	Severe	Very Severe
Under 1800 Rpm			
Up to 10 hp	3-5 Yr	1-2 Yr	6 Mo
10 to 50 hp	1-3 Yr	6 Mo to 1 Yr	3 Mo
Over 50 hp	1 Yr	6 Mo	3 Mo
1800 Rpm and Over	6 Mo	3 Mo	3 Mo

Standard Conditions—Ambient temperature under 100 F, 8 hr per day or less; clean atmosphere; steady load.

Severe Conditions—Ambient temperature 100 to 150 F, or 24 hr per day operation, or dirty atmosphere, or shock or vibrating loads, or frequent starting or reversing service, or excessive conducted or radiated heat to motor

Very Severe Conditions—Ambient temperatures above 150 F, extreme loads where heat is transmitted directly to motor shaft or where frequent and prolonged starting periods are required.

The term "General Lubrication" applies to all once-through oil application methods such as oil holes, bottle oilers, wick-feed oilers, oil cups and mechanical forced-feed lubricators. A straight mineral oil is generally used for general-lubrication applications. "General purpose" grease lubrication refers primarily to grease fittings installed on machine tool parts by the manufacturer. A No. 2 NLGI consistency grease of premium quality will suffice for the great majority of applications.

Table V covers the proper viscosity of oil and grease for electric motor bearings. And Table VI presents a guide to relubrication periods for greasing electric-motor, anti-friction bearings, taking into consideration the motor horsepower, speed and conditions of service.

Lubricant suppliers offer an extensive choice of oils of varying quality and functions. Some oils are especially compounded to meet specifications set up by machine builders. Others have been uniquely formulated to perform such functions as constant cleansing action, anti-stick or anti-leak properties. Users should keep informed relative to new products which may aid them in reduction of maintenance and operating costs.

No carbon copies in industrial safety

Plant safety is a lot like health and money. The more you have, the less you appreciate it. And just as few people have the same health or income, no two plants have exactly the same safety needs. In short—there are no carbon copies in industrial safety.

Do you know what your company pays for compensation insurance? How does it compare with your industry? Some metalworking firms are paying premiums that are 30% to 40% higher than the average for their field. Not only that, they are lowering productive efficiency with needless accidents. On the other hand, some metalworking companies pay 25% below average for accident coverage. What makes the difference for them?—a thoughtful approach to accident prevention.

How can you develop accident controls tailor-made for your plant's needs? The first step is to realize that safety is a management responsibility, that accident controls must be integrated with production controls. Next step is to draw up a safety "balance sheet" pointing out your plant's weak and strong points. Then comes an analysis of the situation to develop the controls you need to strengthen your plant's safety position. Here it may sound simple, but in practice it can be complicated.

But outside help is available. Many companies, even those that have full time safety staffs, have enlisted the aid of outsiders in safety planning. Your workmen's compensation carrier, for instance, has safety engineers who will be glad to furnish advice. Here's how one insurance company, Employees Mutuals of Wausau, helped a metalworking plant recently.

One of the insurance company's safety engineers analyzed the plant's accident record and safety controls. Here is what he found:

1. There was a sharp increase in the number of employees who seemed oblivious of their safety responsibilities.

2. Eye and foot injuries were mounting badly in the plant, both in numbers and in severity.

3. Noise levels in some parts of the plant were reaching critical levels—some employees were threatened with deafness.

4. Plant expansions had given rise to an unhealthy dust problem.

The engineer's analysis showed a glaring need for stronger safety planning. Acting on his recommendations, the plant drew up a safety program:

- Management issued a statement of policy, making it clear that all supervisors were accountable for safety in their work areas.
- Foremen and other plant supervisors were trained to make safety inspections in their own work areas. Every month the plant's safety director made supplementary inspections. The result has been prompt detection of hazards.
- Job descriptions were written for every employee, pointing out specific safety responsibilities. This brought about a more efficient use of medical exams in job placement which, of course, has a direct effect on individual safety performance.
- A training program was set up to teach foremen methods of instructing new employees in the safe performance of their jobs. Safety education was stepped up for all employees, stressing current problems.
- A 100% eye-protection program was started. Foot protection was introduced where necessary. The company expects to achieve 100% foot protection in the near future.
- Company engineers consulted with the insurance company's industrial hygiene engineers. They redesigned the ventilating system to hold dust concentrations well below critical levels.
- Noise levels were surveyed throughout the plant and noisy operations were isolated where possible. Every employee had his hearing tested. All employees who worked near noisy equipment were fitted with ear protectors.

This metalworking plant discovered some important things about industrial accident prevention. It found that effective controls can't be developed through token gestures, through management lip service, through sporadic pep talks and once-a-year campaigns.

This plant discovered that safety must be built right into the production line as a matter of everyday concern to all. It found it needed a flexible plan to meet daily changes as well as top-to-bottom teamwork to carry it out.

How about your plant's safety problems? You can borrow a safety blueprint about as satisfactorily as you can read with your next-door neighbor's eyeglasses. For effective, long-range accident control every plant needs its own prescription.

Watervliet Arsenal advances gage

Big guns have up to several hundred parts. Some of these pose some stiff gaging problems. It's big business to design, procure, store and issue 130,000 gages, some of which cost up to $7,000. To handle these tasks, the arsenal must have a gage laboratory capable of performing all types of measurements and a gage-design group that can constantly develop, simplify and improve gaging practices

By Rupert Le Grand, senior associate editor

Leadership in gage development is historically a characteristic of Watervliet Arsenal personnel.

On July 27, 1819, Major Dalliba, first commanding officer at Watervliet Arsenal, wrote to the newly created Office Chief of Ordnance:

"The shells as a lot are not good . . . I did not pass as receivable more than one fourth of the number cast.

"I have provided a . . . full set of instruments for inspecting cannon . . . , *but they are only for my own use* . . . Another instrument is for measuring diameters and variations of every kind of shot and shell, but . . . no regulations have as yet been promulgated by the Chief of the Department (for parts inspection)."

Major Dalliba's letter went on to discuss inspection problems that still give us trouble. In the intervening 140 years, solutions to many problems have been found. For example, hand fitting of parts to a master and testing for function have long since given way to interchangeable manufacture.

Since 1887, the Arsenal has devoted itself almost entirely to the design and production of cannon. Today, the facility is a research and engineering center, and a storehouse for method's information, pending the time when private industry must manufacture cannon in great quantities. One of Watervliet's major responsibilities is to prescribe and design gages for use in contractor's final inspection and by government inspectors at contractor's plants.

Through the energy and foresight of Arsenal personnel, two activities have been greatly strengthened in recent years:

1. The building and equipping of a gage laboratory. Here the finest equipment from the U.S. and Europe is available to make virtually any type of measurement. The laboratory can function, if need be, to perform metrology functions on a par with the National Bureau of Standards, should an emergency interrupt communications.

2. The organization and staffing of a gage-design section capable of dealing with the problems imposed by modern, light-weight, rapid-firing weapons, and in addition possessed of the background training and imagination to initiate gage developments with vendors.

An example of forward thinking in gage design can be cited: The powder chamber of a gun tube represents a problem area for gaging. Four tapered zones are involved. Dimensions of the zones and their relation to the rear face of the tube were controlled by four flush-pin gages, in which the flush-pin steps represent diametral tolerance. A full-form gage is applied last to control the eccentricity permissible between the four tapered zones.

These gages miss an important characteristic of a powder chamber—the surface finish, and possible existence of circumferential recesses that will adversely affect extraction of a steel shell case.

To explore the entire surface, the Arsenal undertook development of a single gage that would replace all the earlier gages. A plate-type gage, consisting of two intersecting plates with a slidable air-gage tracer along the developed cam edge of one plate, was envisioned as the needed device. If this gage enters the chamber to its full depth, entry of the shell case is assured. The tracer would explore the entire length of the powder chamber to determine diameters, locate the various zones and find any recesses or kinks that were missed by the previous method.

Symbols of Original Thinking . . .
These wooden gages for cannon shot are proudly displayed at Watervliet Arsenal. They were devised in 1819 by the then commanding officer in absence of suitable instructions

Acme Thread Gages Made to Tenths

The cannon barrel or tube is assembled to breech rings by means of an Acme thread, and is located by a key. The pressure flank of the thread and its relationship to the keyway and rear face of the tube must be carefully controlled. This requirement is imposed because any deviation of the pressure flank is reflected in rotational error in a ratio of 40 or 60:1.

To handle making of Acme thread ring and plug gages, the Arsenal installed a Jones & Lamson thread grinder with capacity up to 36 in. dia by 6 ft long. External and internal heads are incorporated in the 66,000 lb machine. The grinder is capable of producing threads with a lead accuracy of 0.0003 in. total

error in 24 in. and of holding tolerances relative to eccentricity, roundness and diameter to within 0.0003 in. To attain such accuracy, it was necessary for the builder to supply a leadscrew error compensatory device, or "former." This cam-like attachment is developed so that a ratio of 0.0378 in. on the cam equals a change in lead of 0.0001 in.

Optical Gaging of 106 mm vents

The development of recoilless rifles has presented ordnance inspectors with serious gaging problems in connection with components that incorporate the vents or ports through which gases are exhausted. Because the amount of recoil is affected by the cumulative effect of variations in port characteristics and ammunition, and because the port contour does not lend itself to any type of mechanical gaging, some definitive method of measuring the port contour must be provided. Spare-part assemblies must also be checked to insure that the recoil permitted will satisfy specifications without recourse to proof firing.

An optical gage to satify these requirements has been developed for use on the vent assembly for the 106-mm rifle. The mechanism on which the tracer arm bracket is mounted is free to move in two horizontal directions so that the disk can follow the contour of the vent opening. The reticle (the rectangular glass plate mounted behind the tracer arm bracket) carries outlines of the limits of the vent form. The reticle moves with the tracer and is projected onto the screen chart which contains a circle representing the tracer disk. At all points the circle outline must be tangent to or between the limit lines of the contour.

This gage provides for rapid accurate checking of a complex form by unskilled personnel and permits economical modification in the event of an engineering change, because only the reticle is affected.

Bore and Rifling Concentricity

Critical requirements are established for concentricity between the bore diameter and rifling groove diameter in a cannon tube.

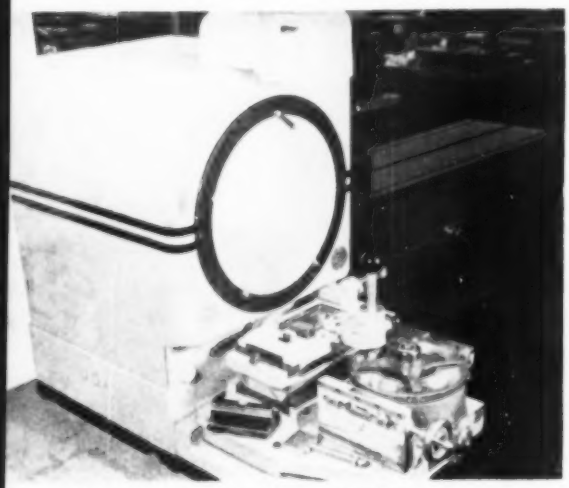
In the past, the best available, but slow, method of checking this concentricity requirement was by use of a star gage. This method required that two readings be taken from a

Some Major Inspection Devices Used in Gage Laboratory

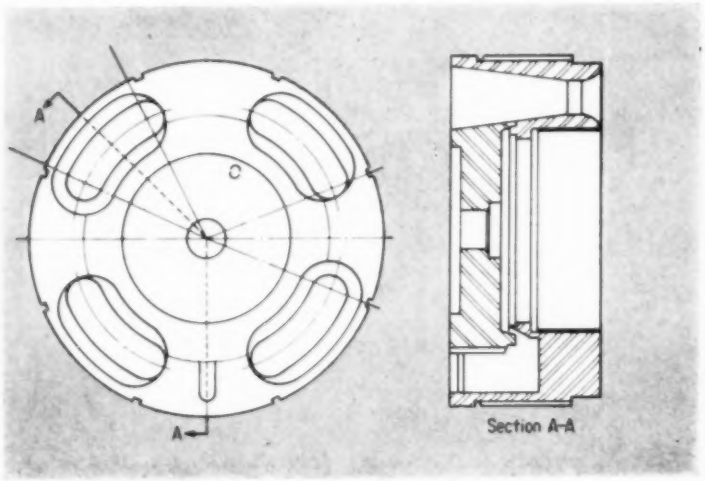
Measurement	Equipment and Use
Out-of-Roundness	Talyrond. Size or diameter checks on mating parts are often not sufficient. Example: piston and cylinder, where undetected lobing of the piston would affect leakdown rate, or recoil rate.
Thread lead	Sheffield. Leadscrews up to 6 ft have been checked. Adapters permit work to be set up on centers or on V-blocks. Arsenal likes to make independent check of opposing flanks as on Acme screws. On large thread gages, the pressure flank is closely controlled. A centralizing device orients the form radially.
Surface Finish	Zeiss interference microscope. Extremely fine finishes require use of interferometry to record surface quality. See Special Report No. 476 (AM—Aug 10, '59 p 105) and (AM—July 27 '59 p 96).
Nicks and burrs	Stereo Microscope. Nicks and burrs on gage blocks will ruin or scratch others in the set. To catch potential offender, a stereo microscope is employed.
Gage-block flatness	Optical flats are employed to check flatness of gage blocks. Flatness of blocks may alter with time and use.
Gage-block size	Hilger interferometer. This instrument was chosen for "absolute" measurement of lengths up to 4 in. because of its capacity: two platens will take 18 blocks for "soaking," i.e., reaching ambient (20 C) temperature. The interferometer is, of course, the ultimate in accuracy for determinations paralleling the accuracy achieved by the National Bureua of Standards. For comparison checking, a Cleveland electronic comparator that reads to one millionth is employed. Wear of master gage blocks is no problem, but growth is, likewise distortion.
Optical Comparators	Two Eastman Kodak comparators with 14-in. screen and surface illumination attachment. One Bausch & Lomb with 18-in. screen. One Jones & Lamson with 30-in. screen. All four instruments are used in two basically different ways: (1) To inspect and certify final inspection gages, and (2) for development work in connection with gage designs. By use of indexing and staging fixtures, the capacity of these comparators is extended.
Surface plates	One size, 4 x 8 ft, is commonly used. All gage checker's surface plates are granite.
Circular Measurements	1. Vinco precision dividing machine. 2. Hilger & Watts auto-collimator with calibrated 12-sided precision polygon. 3. Sip Rotoptic 36-in. dividing table.

Guardian of basic accuracy . . .
Hilger interferometer uses both cadmium and mercury 198 discharge lamps for its light source to check gage blocks for size and flatness, using interference or fringe patterns. This instrument will accept 18 blocks at once for "soaking" to ambient temperature

Self-contained gage laboratory . . .
As a critical source of weapons technology and development, the Watervliet Arsenal now has one of the nation's best metrology laboratories. Here basic measurements can be made: absolute length, straightness, flatness, roundness, angularity, and geometrical relationships such as concentricity, squareness and centrality



Venturi vents checked optically . . .
Because of the contours of the vents in some breech rings (see sketch), mechanical means cannot be used for inspection. This setup was built by Optical Gaging Products, Rochester. The tracer-arm bracket is free to move in two horizontal directions, so that a carbide-tipped tracer can follow the vent opening. A reticle, which has tolerance outlines of the vent form, moves with the tracer. The form is projected onto a screen having a master circle



finely graduated vernier scale at each point to be checked. The measurements would be compared to determine eccentricity at that point.

An air gage recently developed and designed in the Watervliet Arsenal Gage Section will provide for rapid and dependable inspection for concentricity requirements by semi-skilled or unskilled personnel. (See photo.) Two sensing devices assembled into spring-loaded elements which bear against the bore of the tube are mounted opposite each other in a cylindrical plug. In effect, the gage measures depth of rifling at two opposite points simultaneously. Variations in rifling depth are magnified 250 times at the base instrument where the readings are taken. Instantaneous and direct comparison of the two readings and resulting eccentricity can be made continuously as the gage head is pushed through the bore.

Most parts of the air-gage assembly are common for all guns from 40 mm up. Therefore, more economical procurement is possible. Gage storage and maintenance of stock records and drawings are simplified.

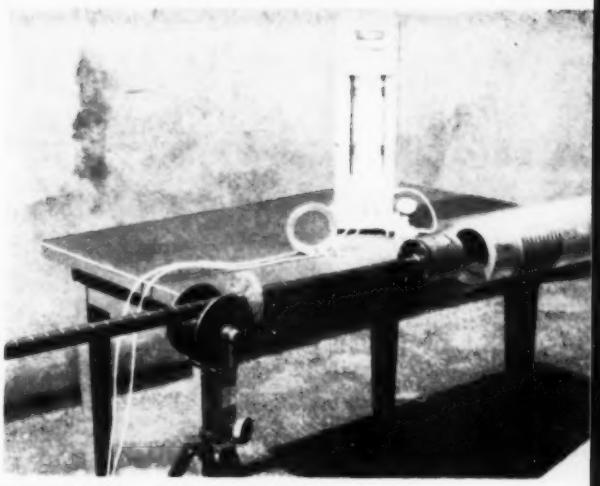
Bore and rifling diameters

The diameters of the bore and rifling in a cannon tube are ordinarily measured with a star gage.

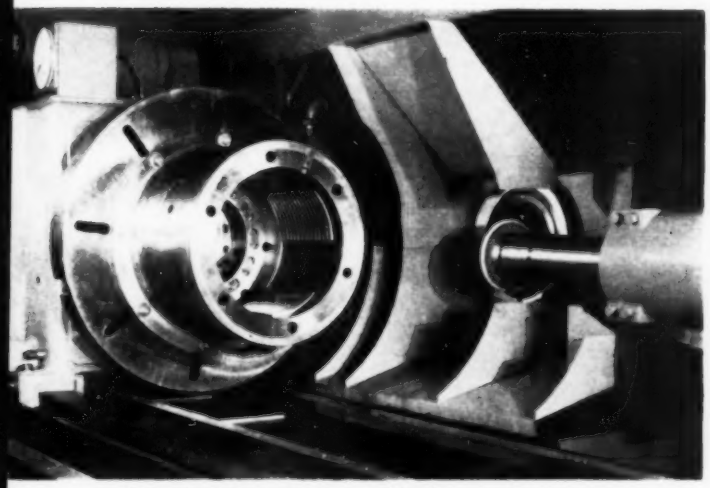
To decrease the high inspection costs when using star gages, air-gage spindles to gage the bore and rifling diameters simultaneously, using semi-skilled or unskilled personnel, have been designed.

Use of air gages will permit magnification of diameter variations 500 times at the column where the readings are taken. Limit marks on the scales will be provided so that the inspector can immediately determine

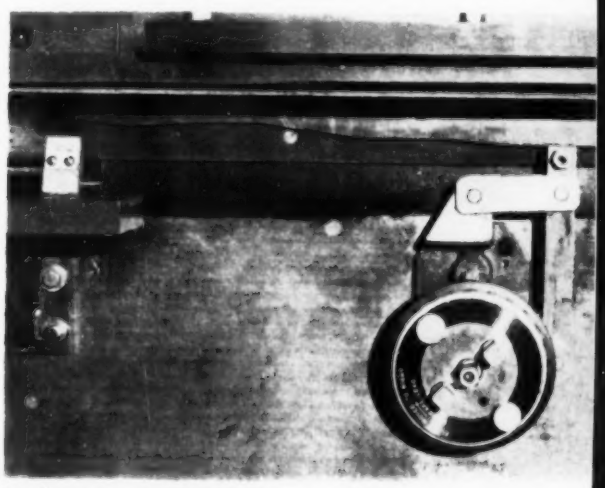
Master gear checker . . .
Master spur gears for gear gages are inspected with this Carl Mahr involute form checker. The device has a stylus that traces the gear tooth and records its deviation from the true involute. Magnifications are either 500 or 1000 times. The optical base-circle setting is infinitely variable between 0 and 20 in. dia



Concentricity of bore and rifling . . .
To speed the gaging of cannon, air gaging is superseding the use of the star gage. The gaging head has two sensing devices, which measure the depth of rifling at opposite points and show eccentricity. Variations are magnified 250 times by the Sheffield "Precisionaire"



Breech-ring gages are critical
The entire envelope of a breech-ring thread must be checked because of a combination of several sources of error. Pressure flank location of thread must be accurate to 0.0003 in. Grinding of gages is done on an outsize J & L thread grinder with capacity of 36 in. dia by 6 ft long. Some gages weigh 400 lb., cost $7,000



Leadscrew compensator . . .
To compensate for lead errors in the leadscrew of the J & L grinder, the machine was fitted with a compensating device. The camlike bar was developed for the screw. In this case, a change in lead of 0.0001 in. is represented by a rise of 0.0378 in. on the cam

whether or not the diameters are within tolerance. The gage will read continuously as the spindle is pushed through the bore.

Most parts of the air gage heads and assemblies will be common for all guns.

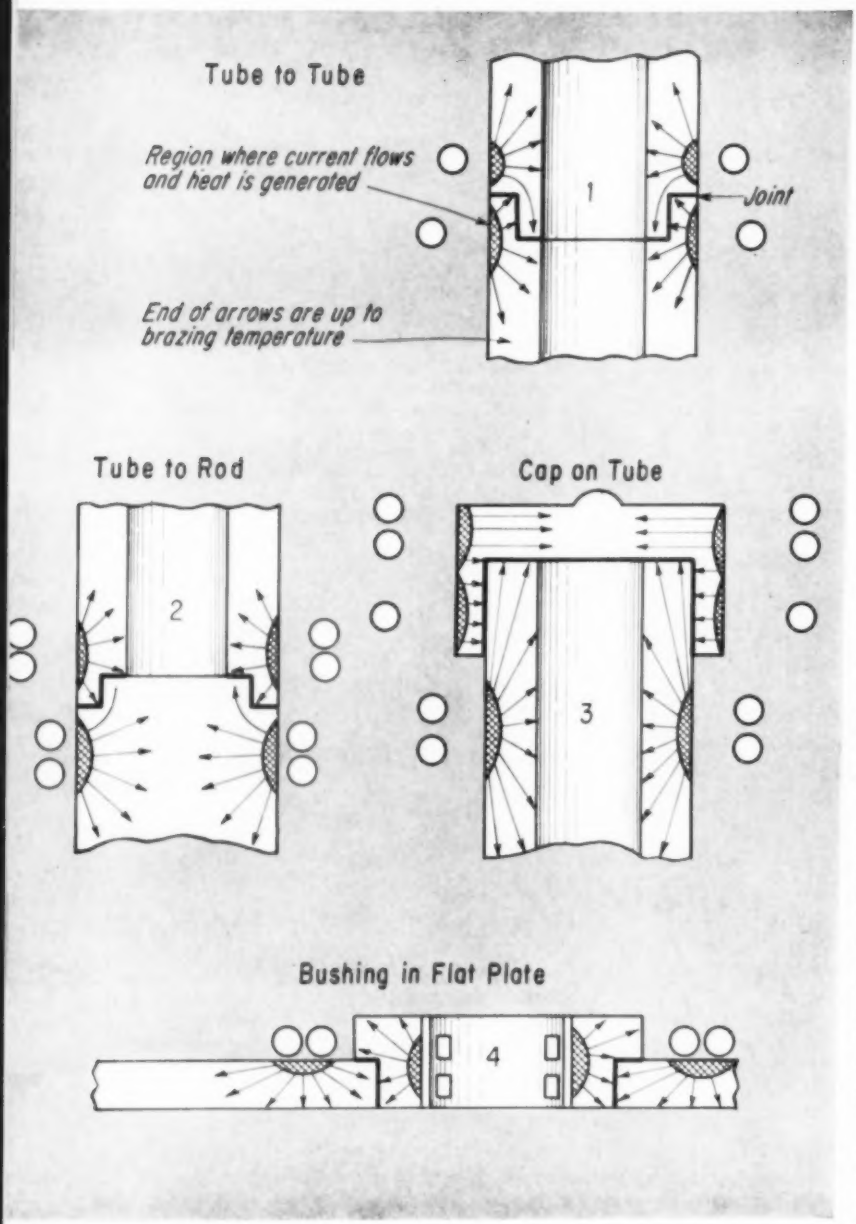
Bore-straightness inspection

Measurement of bore straightness has become increasingly important as a result of requirements for greater accuracy in weapons. Occasionally, a bore with excessive deviation from straightness will be discovered after the gun is shipped to a proving ground. If the Ordnance Inspector at the manufacturer's plant is provided with a convenient, accurate means of checking the straightness of a bore, the defective tubes can be isolated at the source.

The Arsenal has developed a method of checking bore straightness which overcomes the disadvantages of the previous methods. Inspection time can be reduced to approximately 15 min, only one man is required, and displacement is read directly without need for further computation.

The new method makes use of an alignment telescope mounted in a partial sphere which pivots at the center of the bore at the muzzle end of the tube. A line of sight is established from the telescope to the center of a target mounted in a holder which is central in the bore at the breech end. The telescope is then left in position as the target is drawn through the tube by means of a light cable. Deviation of the target from the line of sight is read directly as linear displacement. Readings are taken in the horizontal direction only to avoid the effects of normal sag.

INDUCTION HEATING . . .



Heat flow patterns in brazed joints . . . depend upon the number and position of the induction heating coils, which, in turn, depend upon the mass of metal to be heated and the joint design. In Fig. 1 the upper coil is nearer to the assembly, so as to drive more heat into inner section of the joint. In Fig. 2 the lower coils are closer because of the greater mass of metal in the rod. This joint design permits precise location and gives maximum strength. In Fig. 3 only one coil is used at lower section of cap, because conduction from below will bring inner material to temperature. In Fig. 4 coils are located both inside and outside the assembly. If heat were applied to outside only, plate would expand away from bushing, making it extremely hard to get heat to the bushing

By D H Lapray,
Industrial Heating Dept, General Electric, Shelbyville, Ind

The more jobs a tool can do, and the faster it can do them, the more valuable the tool. Induction heating, still a relatively new process, certainly fits this description—it can melt metals, join, purify or heat treat them, all at high speeds.

For a tool that can do all these things, an induction heater is a far from exciting looking piece of equipment. Picture a black box which we can call the power supply. Attached to this is a copper tube wound into a spring-like helix to form an inductor coil. Through this coil we will run cold water. Now let's put a steel bar inside this coil and turn on the power supply. Almost instantly the surface within the inductor coil will will get red hot, then incandescent, and then melt within seconds. All of this occurs so fast that you can grab the bar within a few inches of the molten zone without getting burned.

All this time the copper coil has remained cold and was never in direct contact with the steel. Where, then, does the energy to heat the steel come from?

Functionally, what we have is nothing more than a transformer in which the inductor coil acts as the primary, and the steel bar, or charge, acts as a shorted-turn secondary. The current induced in the bar is concentrated in a thin outer shell, and the electrical resistance of the bar causes an I-R loss which appears as heat. If the bar is magnetic, additional heat will be generated through hysteresis losses.

Current penetration

The depth of current penetration (that is, the depth within which 67% of the current flows) is an inverse, square-root function of the frequency. It also depends upon permeability and resistivity but, since these are properties of the material being heated, they will not be discussed here. As frequency increases, depth of heating decreases. This must be kept in mind when selecting equipment for any given application.

In general, the lower frequencies are used for through heating, the higher frequencies for selective heating. The most common frequencies for induction heating are 60 cycles;

fast, clean, versatile

1000, 3000, 4200, and 10,000 cycles; and 200,000 to 450,000 cycles. Recently there has been increased interest in the one-to-five-megacycle range for heating very thin materials and purification of semiconductors such as germanium and silicon. Some 180- and 360-cycle equipment is in use.

Economical heating

Many people feel that induction heating is too expensive, both in original capital investment and in operating costs. This is not necessarily true.

The capital equipment investment will be approximately one-half the cost of a roller-hearth furnace of equal capacity and, in addition, the induction equipment should pay for itself in about $1\frac{1}{2}$ years from savings in electricity and manpower alone.

Consider these advantages of induction heating:

- Heat is supplied only where needed
- Time cycles are very short
- In-process inventory is reduced
- Process is repeatable
- It is adaptable to assembly-line, even to controlled-atmosphere work
- No highly skilled labor is required
- Working conditions are pleasant

Power requirements

In the sketches on page 138 the arrows represent heat gradient arrows, the points of which indicate areas at brazing temperature. Naturally, some heat will be conducted to areas beyond this zone. The mass of material that must be brought up to brazing temperature (plus that which is at lower temperatures) determines the power requirements.

The area heated will, of course, vary somewhat with the material used. For example, copper, because of its high rate of heat conduction, will have a much larger heated volume than will steel. Heating rate must also be considered. In general, a volume equal to twice that which is brought to brazing temperature

Power Requirements

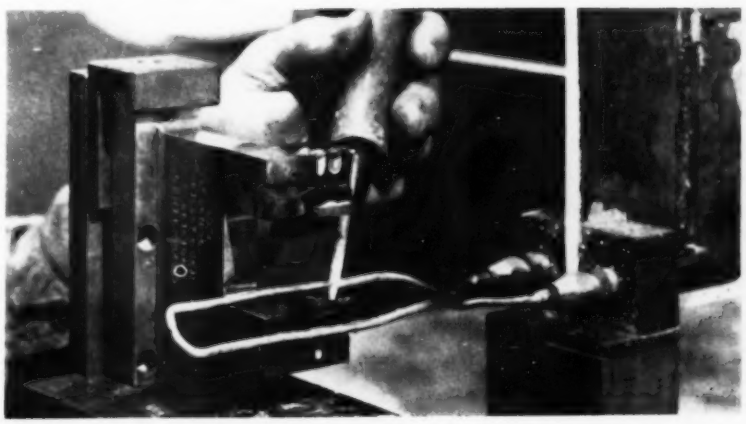
$$\text{power req'd} = \frac{(N \times \text{lb}) \times (\text{heat absorption of metal})}{\text{Coupling efficiency}}$$

where power req'd = Kw output of generator
N = number of joints per hr
heat absorption = Kwhr per lb to raise metal to brazing temp.
coupling efficiency = fraction of generator output converted to heat in load

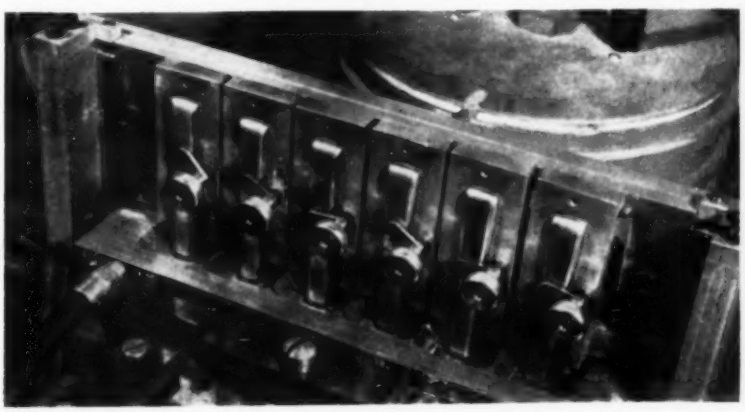
Average Coupling Efficiencies

	500 kc		10 kc	
Type of coil	Magnetic steel	Other metals	Magnetic steel	Other metals
Helical, around work	0.80	0.60	0.75	0.50
Pancake	0.50	0.30	0.35	0.25
Hairpin	0.60	0.40	0.45	0.30
Transformer coils*				
one turn around work	0.70	0.50	0.60	0.40
Channel	— rarely used —		0.35	0.25
Internal	0.50	0.25	0.40	0.20

*includes transformer losses



Brazing carbide tips to gage . . . resulted in 66% production cost savings. Hand torches were used previously. Company saves 20 minutes per piece, gets air-tight bond, clean air-jet holes, and holds dimensional tolerance of 0.020 in. Coil is hand-made. Soldering tool (in hand) simply positions tip



Multiple fixture for silver-brazing ▶ joins knife handles to blades six at a time. Heating coil is split type that opens at each end, permitting parts to be conveyed into place. Loading, positioning, heating, and unloading are done on rotary table. Induction heating installation saved user $75,000 a year

Valve-stem tips are hardened . . .
at a rate of over 4000 per hr by the heating coil of this 25-kw induction heater. Valves pass through the inductor coil and into an oil quench, then drop into a tote box. Note the low-impedance transmission line from power supply to coil

can be considered as the mass which will be heated. From these factors we can determine the size of equipment required. The power required can be calculated from the equation on page 139.

Frequency of power source

Next point to be considered in choosing equipment is the frequency of the power source. If heat penetration can be tolerated, or is desired, motor generator equipment can be used. A deeper penetration yields faster, more uniform heating.

If the part to be heated is so small that the induced currents would tend to cancel, higher frequencies must be used. Case hardening also calls for high frequencies. For example, a 1000-cycle power source induces a surface current which will harden the outer shell of a part to an average depth of 0.1 to 0.5 in.; 10,000 cycles will normally harden to 0.05 to 0.25 in.; and 450 kilocycles will harden to 0.01 to 0.09 in. In order to heat such surfaces to hardening temperature before the heat conducts too far into the part, a high power density is needed.

If the depth of case hardening is to approximate the minimum values for a given frequency, the power density must be in the range from 5 to 10 kw per sq in.

Electronic oscillators

Where the same equipment is used for a variety of jobs, as in a laboratory or a job shop, electronic oscillators are superior to motor-generator equipment. The electronic oscillator is a variable-frequency power source, and will adjust its frequency to match the load. With motor-generator equipment, it is necessary to correct for power factor and closely match the impedance of the inductor coil to the generator.

Except in special applications, an operator can design an inductor coil which will give the approximate heating pattern desired, install it on an electronic oscillator, and be ready to operate with few, if any, additional adjustments.

Applications

The photograph of the tool-brazing operation shows a simple, if not the most efficient, coil design and illustrates the construction of the power transmission line. Induction heaters make use of what is called a low-impedance transmission line to deliver maximum power to the point of application. Basically, this type of line is nothing more than two flat copper plates spaced approximately 1 16 in. apart and separated by a strip of Teflon. Attached to the side of the line, there is usually a copper tube to carry cooling water.

One unusual application involves the heat treating and simultaneous forming of automotive piston rings. This special machine takes perforated strip material of U-shaped cross-section, heats it, gages the slots, and simultaneously forms it into a circle as it is quenched. A machine such as this is usually developed by the user.

Fixture design

Fixtures for induction heating, as we have seen, run all the way from the most simple support to completely automated machines. Each job must be studied to see what kind of fixturing is needed. Automatic equipment is not always the best answer, even if high production rates are called for. Many times a single operator with some simple fixture can outperform an automatic machine.

There are a few simple rules for designing induction heating devices, the first of which is simplicity. This should be the keynote of every design; it reduces cost and maintenance. Secondly, make sure that any metal, aside from the charge, that is in the proximity of the inductor coil is non-magnetic and, preferably, a low-resistance material such as aluminum, brass, or copper. Otherwise, it will absorb some of the power meant for the charge.

In addition, be sure that there is no closed metallic path in the field of the inductor coil. Break up any such loop with insulating material.

Some of the insulating materials used for fixtures and workholders are Transite, Mycalex, Diamonite, Lava, and Surbraze Ceramica. Most of these have reasonably good resistance to abrasion and chemical attack from flux, and most can be machined and formed to shape.

Recent applications

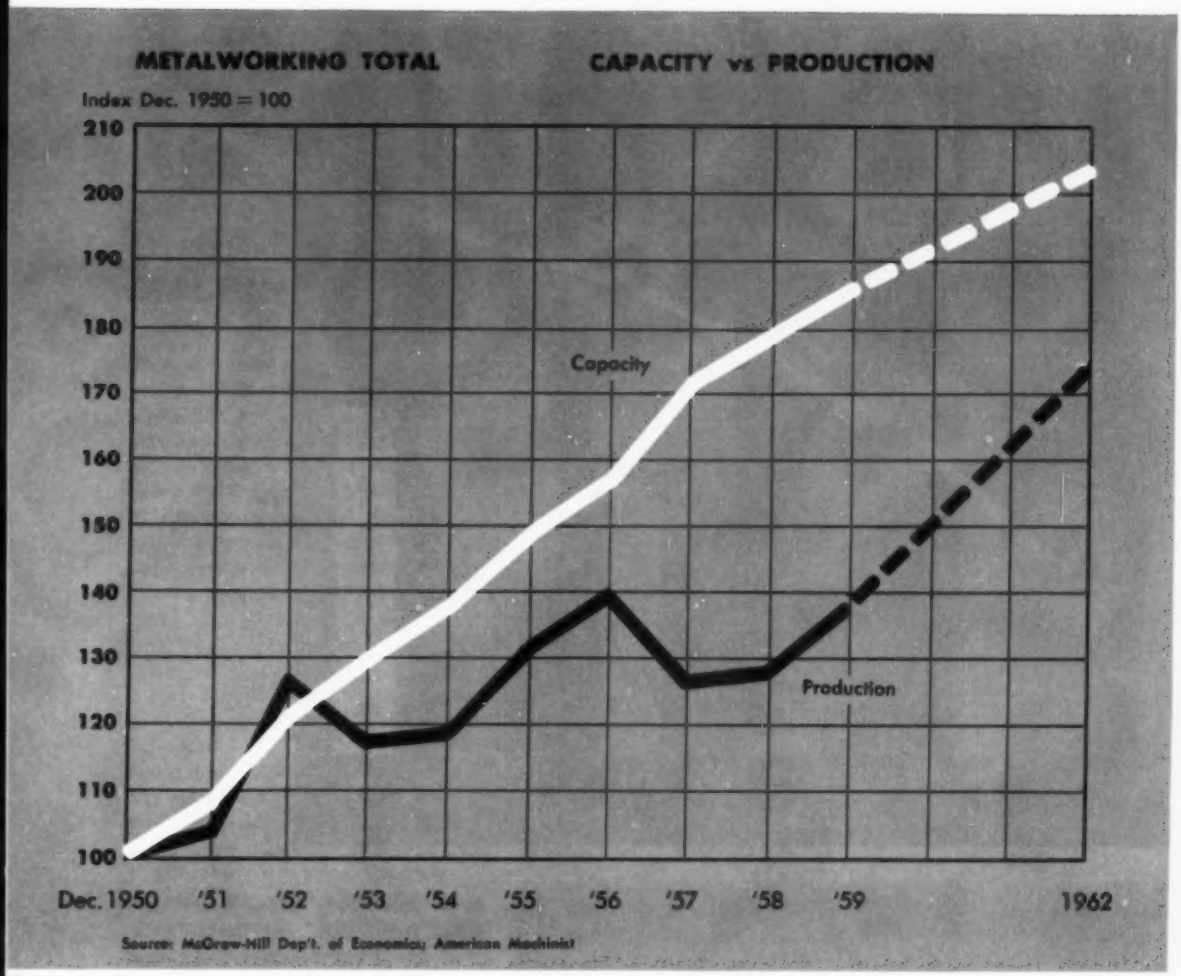
One of the more recent applications is in the purification of metals to obtain ultra-high-purity materials. In some cases the impurities have been reduced to less than one part in two billion. Westinghouse recently developed a process whereby they can refine highly reactive metals such as columbium. Induction heating melts the inside of the ingot while the outside remains solid, thus forming its own crucible.

Induction heating is particularly applicable to extremely high temperature work. Since all the heat is generated directly within the part, secondary heating elements are unnecessary, and finding suitable heating-element materials is becoming a major problem as temperature ranges go higher and higher. Induction heating processes carried out at temperatures of 6000 F are not unusual.

The potential of induction heating has scarcely been tapped. Perhaps you can use it in some of your present operations to reduce your product cost or, even better, adapt it to some new process.

Don't look on it as a cure-all. It isn't. But it may be the answer to your particular problem and, as such, deserves a close look.

Where METALWORKING will be in 1962



Metalworking production has climbed to a new peak. It is headed for higher ground. Where it will be in the early 1960s is spelled out, in the next seven pages, for each major metalworking industry. Forecasts of spending for plant, equipment and R&D are included

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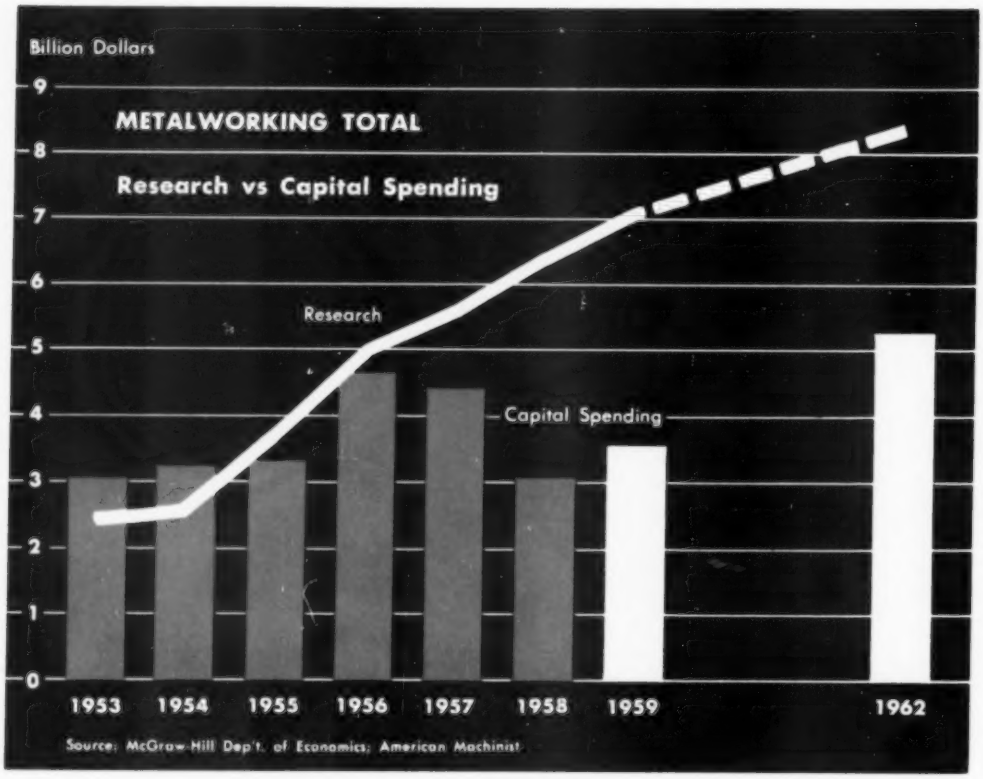
Spending for equipment and R & D to rise, production to set new record



Metalworking staged a faster recovery from the 1958 recession than anyone anticipated. It got up to a new production peak by mid-1959.

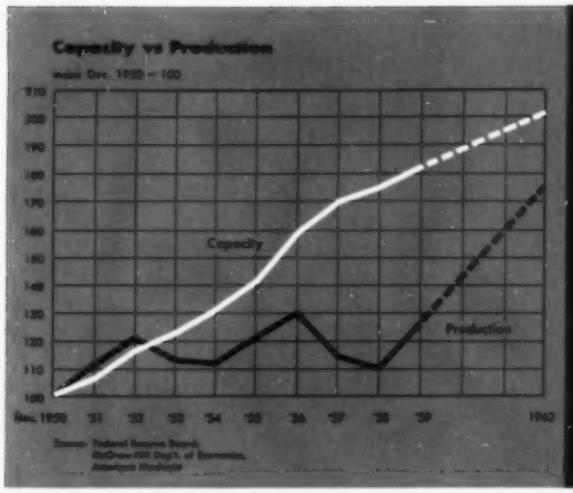
And in 1960 it promises to go even higher. During the following two years, output of metal goods of all kinds should soar to new heights.

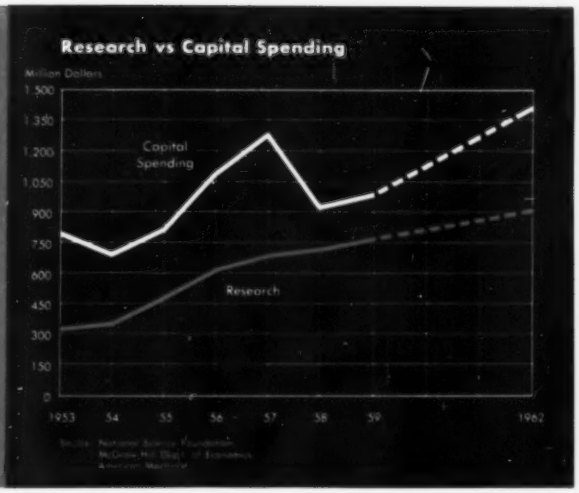
Even with this record-breaking performance, the operating rate has been lower, in relation to plant capacity, than it was earlier in the 1950s because of the huge increase in metalworking production facilities right through the past decade (there was an expansion of 14% in 1957-1958). But demand for the products of the industry is expected to be so heavy the next few years that, by 1962, output will take up at least 85% of available capacity.

More and more money is being poured by Metalworking into research and development. Each year the outlay for such work goes up substantially. Last year the total was $6.4 billion. This year it will be $7.1 billion, and in 1960 $8 billion.

Even now, metalworkng manufacturers are planning on spending $8.4 billion on R&D in 1962. And the final figure probably will be more than that. Expenditures for R&D have been running well in advance of the amounts spent for new plant and equipment. This trend is likely to continue.

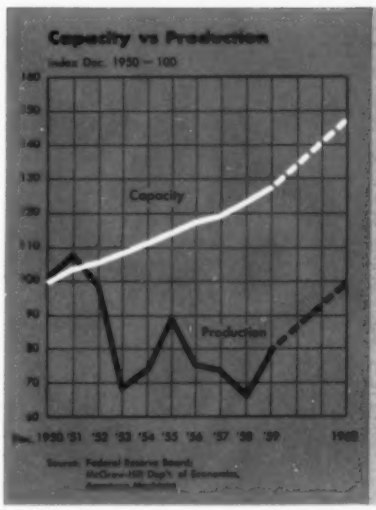
Out of the research work now nearing the commercial stage will come an outpouring of new industrial processes and new consumer products in the early 1960s. This trend will greatly stimulate the tooling up of thousands of plants to make new products. It might well terminate in the greatest expansion in capital goods in history. Capital spending in 1962 is put at $5.2 billion, 47% up from this year.

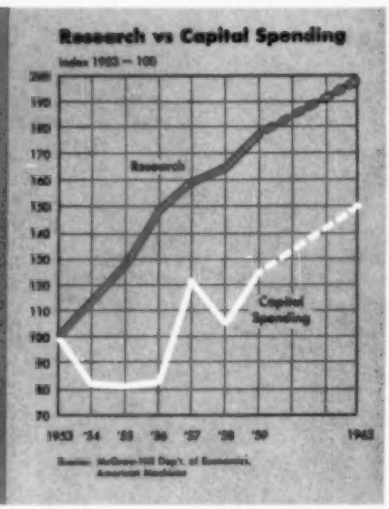




MACHINERY, except electrical

Machinery manufacturers will chalk up new production records in the early 1960 s. By 1962 shipments should rise 35% above the previous peak, spurred by the demand for cost-cutting machines and for added facilities. Related to anticipated capacity, the industry will be operating at around 87% three years from now. It will spend $1.4 billion for new plant and equipment in 1962.



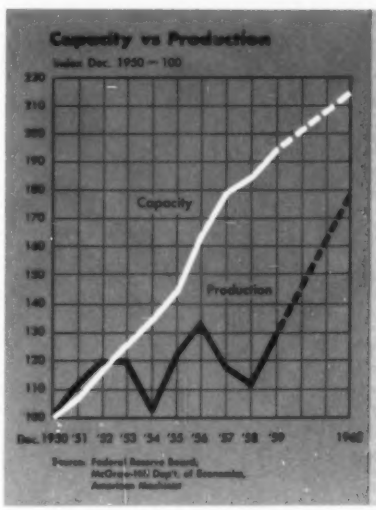


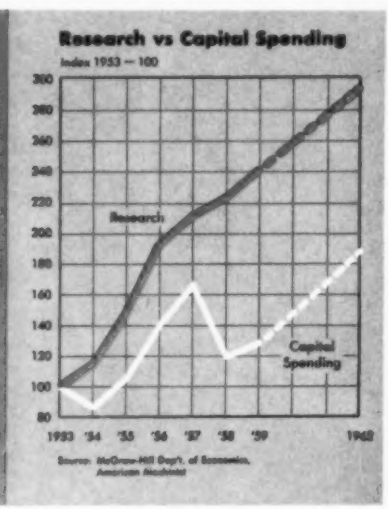
FARM MACHINERY

Farm implement industry has grown less since 1950 than any other industrial machinery group. Its capacity is up 28% and is expected to expand only 15% the next few years. Spending for plant and equipment is one-fifth higher this year than last and will rise another one-fifth by 1962. R&D outlays will be sizable.

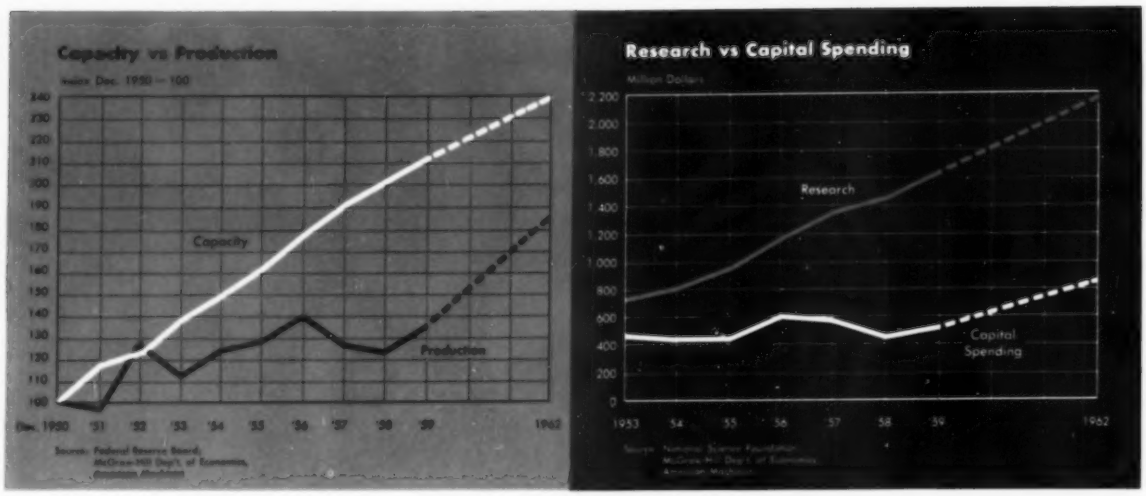
OTHER INDUSTRIAL MACHINERY

Output of construction and mining machinery, engines and turbines, and general and special industrial machinery promises to be up about 38% by 1962. Capacity, by contrast, won't go up more than 11%. R&D spending today is 2½ times what it was in 1953 and will rise to 3 times the next few years.

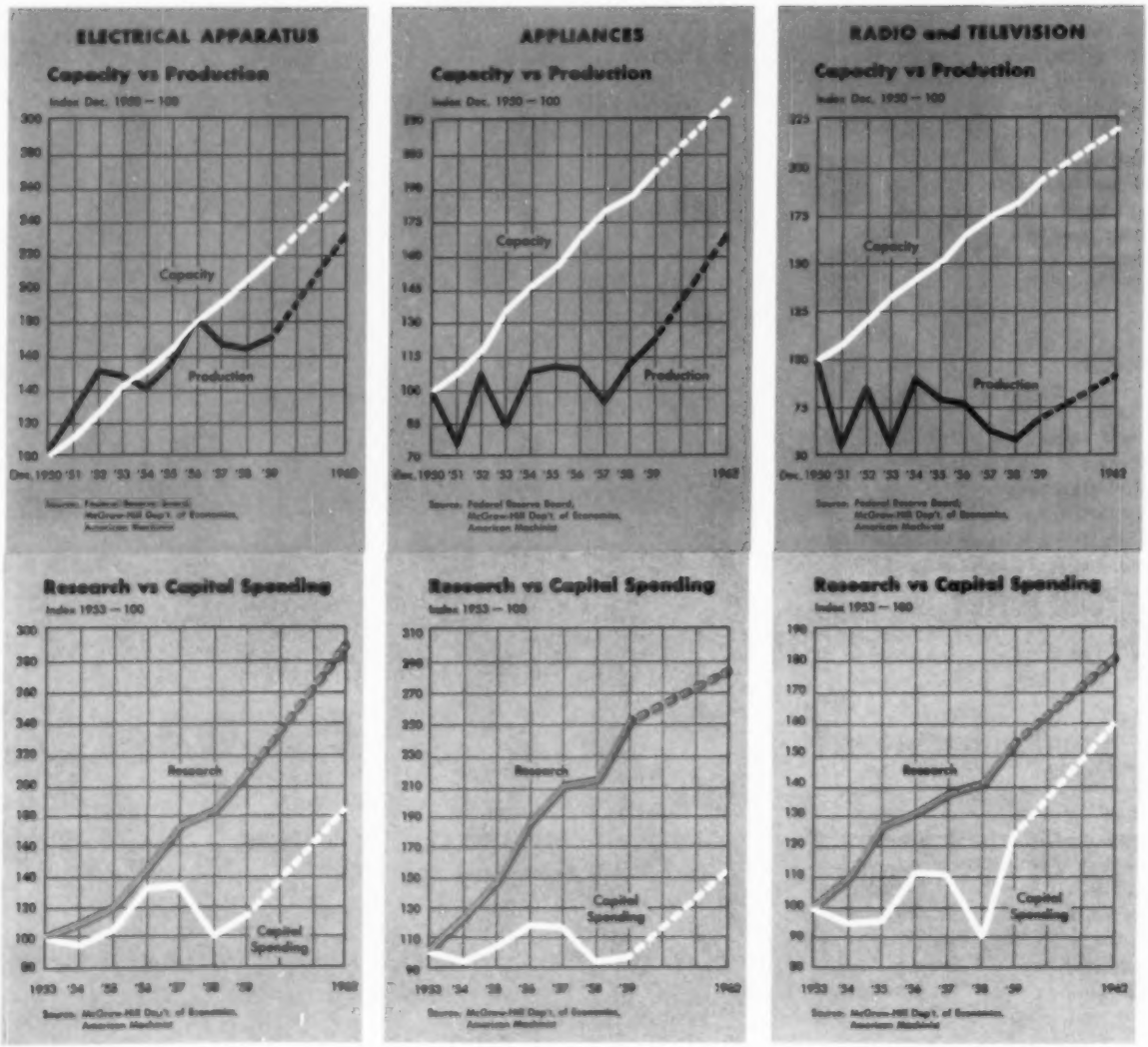




Where METALWORKING will be in 1962 . . .



ELECTRICAL MACHINERY



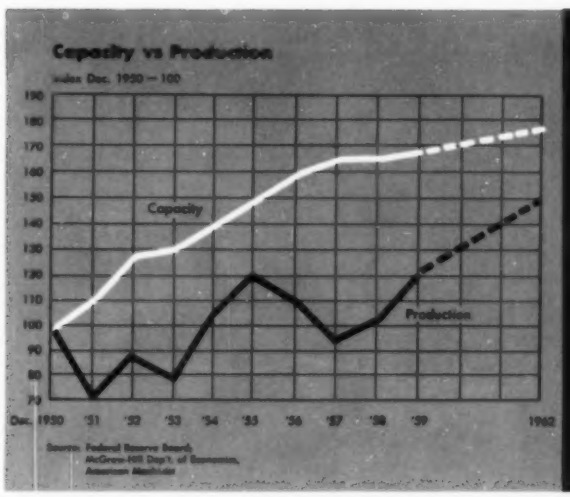
Electrical machinery industry has more than doubled its R&D expenditures in recent years and will boost them to well over $2 billion by 1962. Investment in new plant and equipment is expected to rise to a new peak of $850 million a year early in the 1960s, with some recovery in capital spending already assured this year. Capacity of this industry is likely to grow steadily the next few years, most of all in the electrical apparatus division. Expansion will be sizable in the radio, TV and appliance segments too. Output is up once more, after a drop in 1957 and 1958. It is destined to rise further to a level considerably above any previous point by 1962. At that time, production probably will be at 85% of capacity

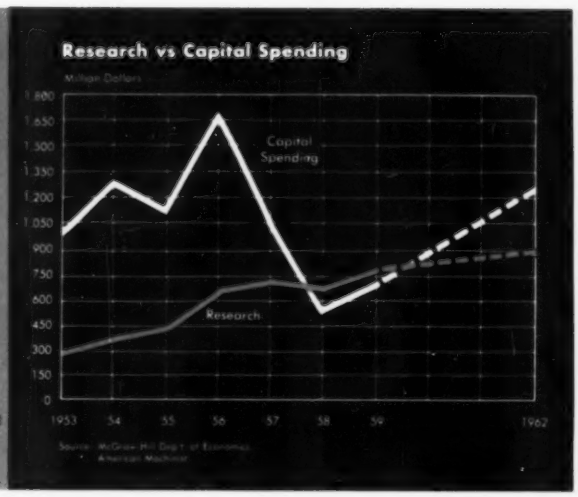
ELECTRICAL APPARATUS

In electrical apparatus, the operating rate in relation to capacity got down in 1958 to the lowest point in more than a decade. This situation will not be corrected until at least next year, when utilities begin placing a heavy volume of orders for new distributing and transmission equipment. It is estimated that the electrical apparatus people will be running close to full capacity by 1962. Capital spending will be up substantially as a result of a tremendous outlay for R&D.

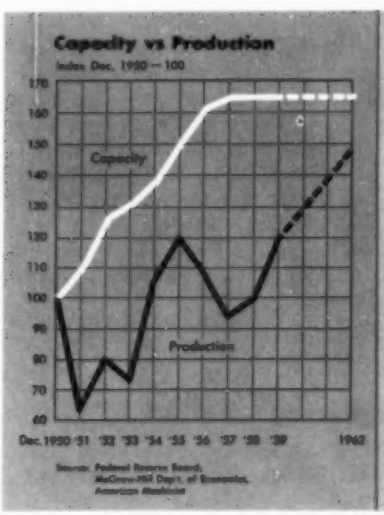
APPLIANCES, RADIO & TV

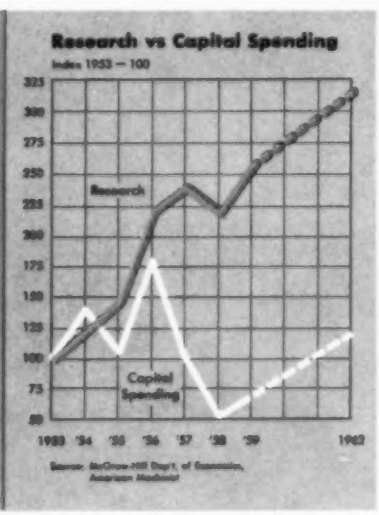
Capacity for making appliances, TV and radio sets now is about double that in 1950. But production has not begun to take up all of this capacity, manufacturers using only 50 to 65% of their facilities most of the time. Only a small amount of new capacity will be built the next three years. Operating rates will outstrip expansion for the first time in years. Radio and TV set makers have upped capital spending to new heights.





AUTOS, TRUCKS and PARTS





Automobile industry—cars, trucks and parts—may well break into new high ground in the early 1960s, following substantial recovery this year from the 1958 low. Spending for plant and production equipment should be up to $1.2 billion by 1962 compared with $700 million this year.

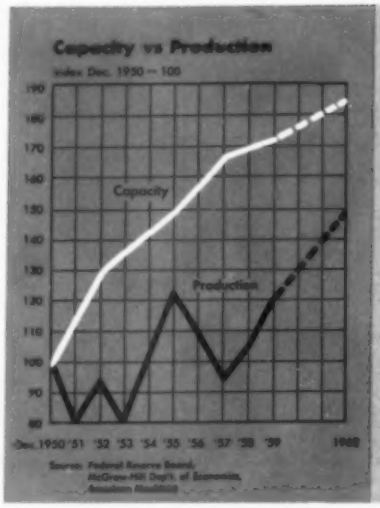
♦ AUTOS AND TRUCKS

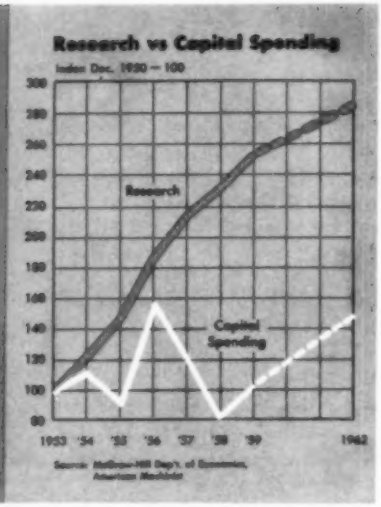
Output of 7.5 million cars and 1.5 million trucks a year is not too much to expect by 1962. At that time production should be up to 80% of capacity or better. Development of small cars and new engines should boost sharply the amount of money spent by auto makers for new production equipment.

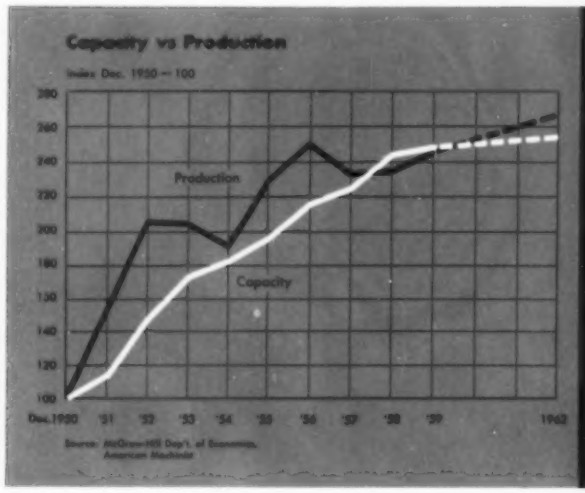
Where METALWORKING will be in 1962 . . .

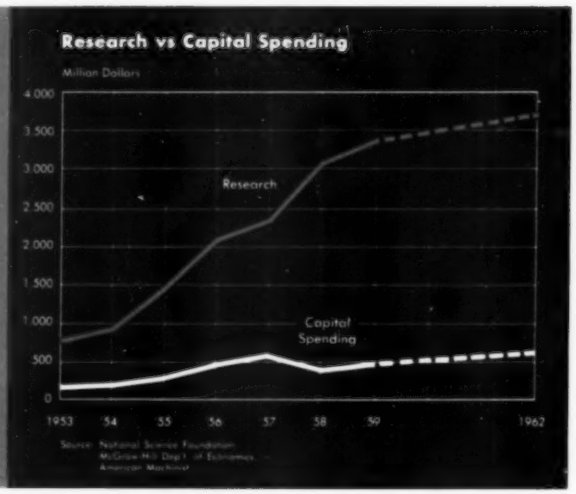
AUTO PARTS

Car parts manufacturers have been increasing their capacity and have been spending money for research and development at a surprisingly high rate. The outlays will be even bigger in the years ahead. Diversification of their products is one of the main reasons for this outpouring of their funds.

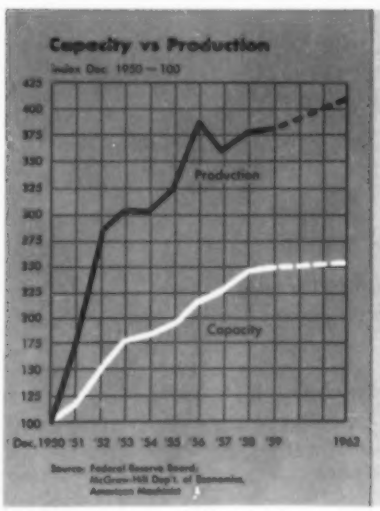


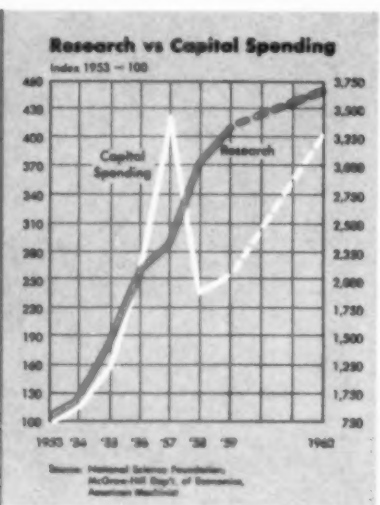






AIRCRAFT, MISSILES and OTHER TRANSPORTATION (except auto)



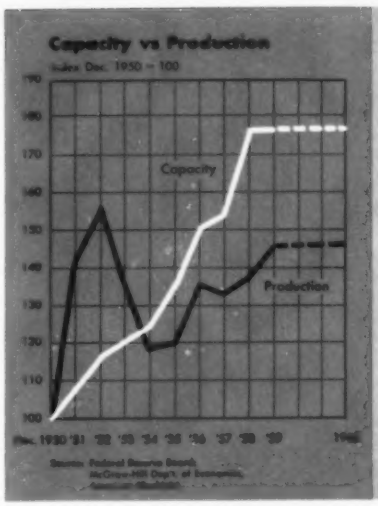


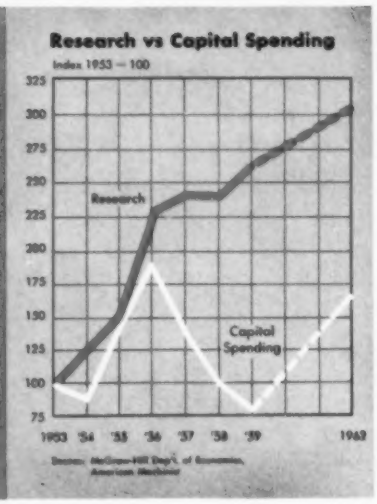
Research and development work in aircraft and missiles, spurred by government money, has reached a level of $3.4 billion a year, four times what it was several years ago. In a few more years R&D spending will be up to $3.8 billion. All segments of the transportation equipment industry will be operating at an all-time high by 1962. A lot of money will go for new equipment but capacity is likely to grow only a small amount.

PLANES AND MISSILES

Over-all production of military planes and missiles probably will not be much higher in 1962 than today. Facilities

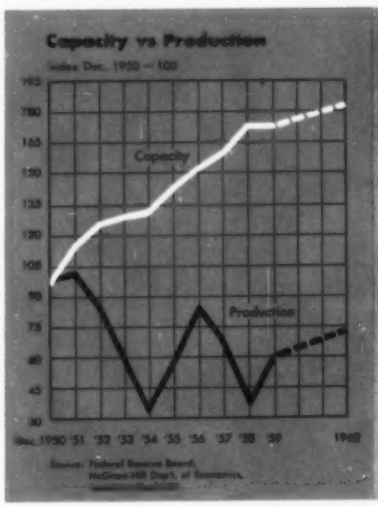
now far outstrip demand, a situation that bids fair to continue. Nevertheless, firms in the industry plan to expand enough to suggest that they are widely diversifying their products. Capital spending will fall short of the 1957 peak level.

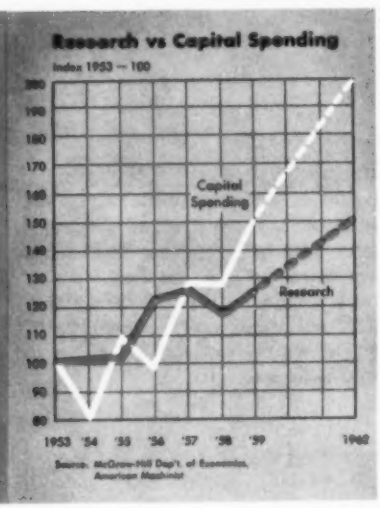




SHIPBUILDING ♦

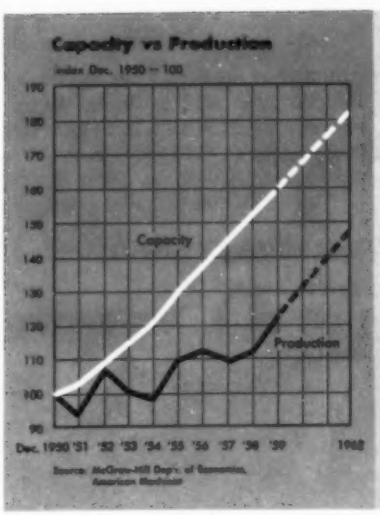
Shipbuilders, with 75% more capacity than 10 years ago, do not expect to add more soon. Nevertheless, operations should be good in the 1959-1962 period, what with a sizable backlog of passenger and cargo ships. Considerable money is being poured into R&D, a trend that will continue.

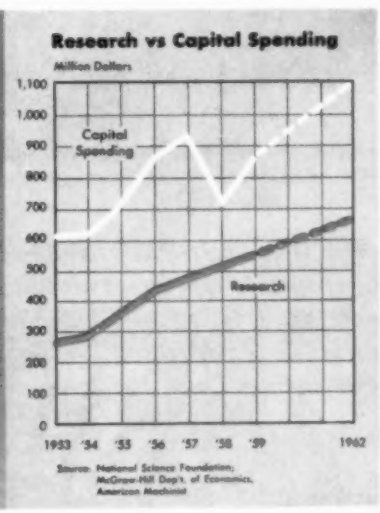




RAILROAD EQUIPMENT ♦

Capital spending has gone to an all-time high in the railroad equipment industry. With a big diversificaton program under way, outlays for plant and equipment probably will rise one-third the next few years. Much of the gain in new capacity can be attributed to a shift into new product lines.





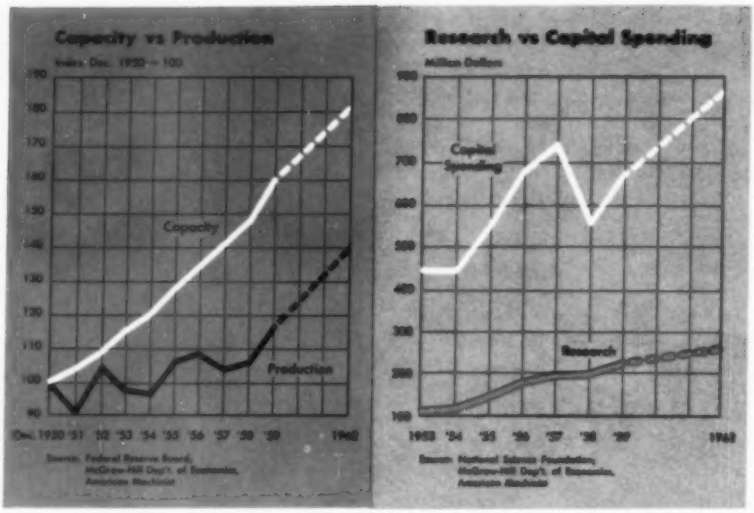
♦ OTHER METALWORKING

Plant facilities of companies in the "Other Metalworking" category are 60% higher than at the start of the 1950s. But output has lagged. Operating rate is sure to pick up the next few years and outlays for new capacity will run more than $1 billion a year by 1962. R&D spending continued to climb the past year and is expected to go up steadily for several years.

Where METALWORKING will be in 1962 . . .

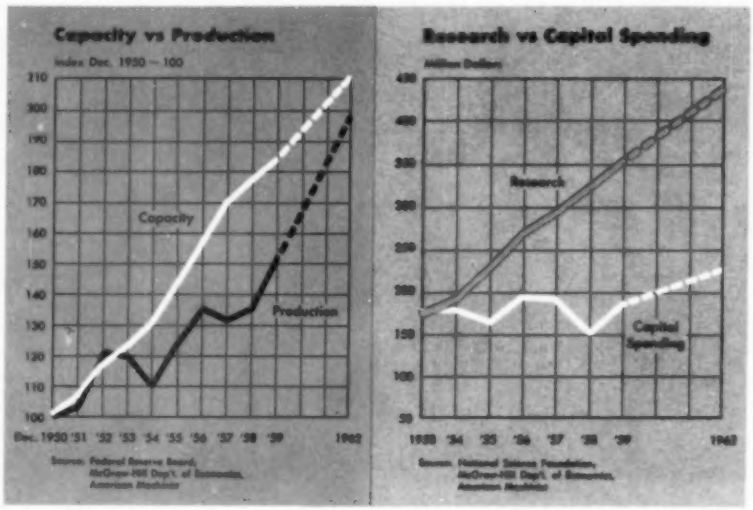
FABRICATED METAL PRODUCTS

Makers of fabricated metal products plan on adding about 25% to their plant capacity by 1962. In the same period, production is expected to rise 30%. Capital spending will be up to $900 million within 2-3 years. Money for R&D is estimated at $250 million in 1962, 2½ times the 1953 rate.



INSTRUMENTS

This year $190 million is being spent for expansion and modernization by instrument makers. That is about the same total as in 1956 and 1957 (1958 was sharply off). In 1962 these expenditures should be up to $230 million. R&D operations have increased steadily and will be considerably higher in 1962 than now.



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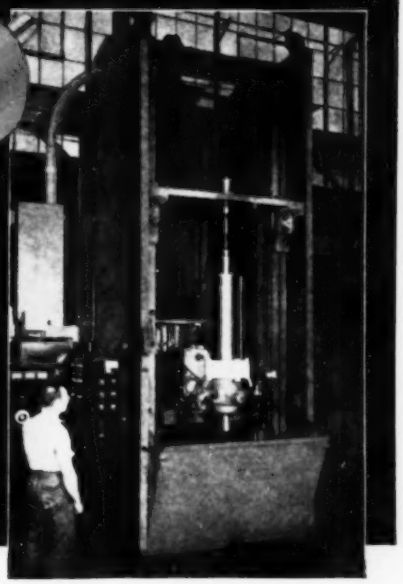
of this and all other* American Machinist *special reports

Order from Reader Service Dept. American Machinist, 330 W 42nd St. New York 36, N. Y. Single copies of this report are 25¢; prices are reduced for quantities over 100. Other reports are priced at 35¢ if 16 pages, 30¢ if 12 pages, and 25¢ if 8 pages. A list of current reprints is available from the Reader Service Dept.

Former Heat-Treating Time—28¼ HOURS
TOCCO Heat-Treating Time—30 MINUTES

Plus

$108 saved on every mill roll



This special mill roll hardening fixture is powered by two 200 KW, 3000 cycle TOCCO machines. Mill roll shown is 12" diameter by approx. 60" long.

with TOCCO Induction Heating

When progressive engineers at The McKay Machine Company switched from conventional heat-treating methods to TOCCO induction hardening of their mill rolls, they achieved not only increased production but also important cost savings, and perhaps most important of all, a greatly improved product.

56 Times as Fast!

Formerly mill rolls required a 12-hour heat, a 15-minute salt brine quench, 12 hours tempering and a 4-hour cooling period. With TOCCO the whole job is done—and done better—in just 30 minutes—56 times as fast!

Here's Real Economy

Reduced furnace time saves $28.00 per roll. More important, grinding time is cut in half (saving $80 per roll) because TOCCO minimizes distortion and there's less stock that must be removed. Runoff used to be as much as ¼"—frequently requiring a separate straightening operation.

Product Improved

Because TOCCO "scans" the mill roll, i.e. heat treats it progressively, only a small section is at critical temperature at any one time. That's why distortion is minimized and little finish grinding is required. This means that TOCCO-hardened mill rolls have a *more uniform case-hardened depth* than possible with old fashioned methods which in turn means longer life and better performance.

* * *

Why not have a TOCCO engineer survey your plant to determine where TOCCO can reduce your costs, increase production speed and improve product quality?

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Please send copy of "Typical Results of TOCCO Induction Hardening and Heat Treating."

Name_____

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Company_____

Address_____

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High voltage "lightning" discharge at a Malleable test block.

Toughness is Malleable

Under the slamming, bruising strain of a bulldozer's roughshod ride . . . inside the battering air hammer . . . against the repetitive concussion of a machine gun's smashing action . . . wherever conditions are really brutal, Malleable iron castings prove their ruggedness.

When you're looking for toughness, it will pay you to investigate Malleable castings. Contact one of the progressive firms that displays this symbol—

MEMBER

MALLEABLE

CASTINGS COUNCIL

If you wish, you may inquire direct to the Malleable Castings Council, Union Commerce Building, Cleveland 14, Ohio, for information.

New Malleable Irons Meet Gruelling Service Tests

Toughness is a vital requirement in stressed parts. Each application, however, requires a particular combination of physical characteristics to be sufficiently "tough."

Whatever the specific requirements, one of the finest groups of materials available is the Malleable irons, as illustrated in the tables below.

Tensile Properties—A.S.T.M. Minimum Specifications
Standard and Pearlitic Malleable Irons

Designation	Tensile Strength p.s.i.	Yield Strength p.s.i.	Elongation % in 2 in.	Designation	Tensile Strength p.s.i.	Yield Strength p.s.i.	Elongation % in 2 in.
Standard				53004	80,000	53,000	4
35018	53,000	35,000	18	60003	80,000	60,000	3
32510	50,000	32,500	10	80002	100,000	80,000	2
Pearlitic							
45010	65,000	45,000	10				
45007	68,000	45,000	7				
48004	70,000	48,000	4				
50007	75,000	50,000	7				

Strengths up to 135,000 p.s.i. tensile and 110,000 p.s.i. yield are produced commercially under individual producers' specifications.

Other Mechanical Properties
Standard and Pearlitic Malleable Irons

	Standard	*Pearlitic*
Modulus of Elasticity in Tension, p.s.i.	25,000,000	26,000,000—28,000,000
Ratio of Fatigue Strength to Tensile Strength	0.54	0.40—0.50
Shear Strength—% of Tensile Strength	80—90%	70—85%
Torsional Strength	Approximately equal to Tensile Strength	
Compressive Strength, p.s.i.	200,000	250,000

Malleable's toughness is illustrated in a severe test conducted by a manufacturer of cab-over-engine trucks. To be absolutely sure of the strength and toughness of a variety of components in the cab, including the critical Malleable iron cab support hinges, a truck was crashed at high speed into a barricade of ice. Result—no hinge damage, even though the truck was seriously battered.

Service-Demonstrated Toughness

Highway railing posts demonstrate Malleable castings' use where impact resistance is critical. As an example, thousands of Malleable railing posts line the Connecticut State Thruway. The State Highway Department reports that there have been no failures of the Malleable iron posts although other materials have failed in several cases.

It is also because of Malleable's toughness that so many of the highest quality hand tools are made of Malleable iron. One leading tool manufacturer tests the quality of its pipe wrenches by using a trick well known as the best way to break a wrench. The wrench jaws are put on a rigid bar, a long pipe is slipped on the handle, and the tester heaves his weight downward on the pipe. Because of their confidence in Malleable's toughness, this company unconditionally guarantees every Malleable wrench housing against distortion and breakage. Another hardware manufacturer makes a similar guarantee against breakage on its line of Malleable vises.

But Malleable iron's proven performance in field service is only one reason for its wide use. To this, you must add Malleable's low first cost, design flexibility, and excellent machinability. This combination offers unique advantages over other metals.

Design and Production Assistance Available

To assist in the use of Malleable castings, a special bulletin on toughness—Data Unit No. 105—is available from the Malleable Castings Council, Union Commerce Building, Cleveland 14, O. These bulletins and engineering and planning assistance are also readily available to you from any member of the Malleable Castings Council.

These companies are members of the

MALLEABLE CASTINGS COUNCIL

CONNECTICUT
Connecticut Mall. Castings Co., New Haven 6
Eastern Malleable Iron Co., Naugatuck
New Haven Malleable Iron Co., New Haven 4

DELAWARE
Eastern Malleable Iron Co., Wilmington 99

ILLINOIS
Central Fdry. Div., Gen. Motors, Danville
Chicago Malleable Castings Co., Chicago 43
Moline Malleable Iron Co., St. Charles
National Mall. and Steel Castings Co., Cicero 50
Peoria Malleable Castings Co., Peoria 1
Wagner Castings Company, Decatur

INDIANA
Link-Belt Company, Indianapolis 6
Muncie Malleable Foundry Co., Muncie
Terre Haute Mall. & Mfg. Corp., Terre Haute

MASSACHUSETTS
Belcher Malleable Iron Co., Easton

MICHIGAN
Albion Malleable Iron Co., Albion
Auto Specialties Mfg. Co., Saint Joseph
Cadillac Malleable Iron Co., Cadillac
Central Fdry. Div., Gen. Motors, Saginaw

MINNESOTA
Northern Malleable Iron Co., St. Paul 6

NEW HAMPSHIRE
Laconia Malleable Iron Co., Laconia

NEW JERSEY
Meeker Foundry Company, Newark 4

NEW YORK
Acme Steel & Mall. Iron Works, Buffalo 7
Frazer & Jones Company Division Eastern Malleable Iron Co., Solvay
Oriskany Malleable Iron Co., Inc., Oriskany
Westmoreland Mall. Iron Co., Westmoreland

OHIO
American Malleable Castings Co., Marion
Canton Malleable Iron Co., Canton 5
Central Fdry. Div., Gen. Motors, Defiance
Dayton Mall. Iron Co., Ironton Div., Ironton
Dayton Mall. Iron Co., Ohio Mall. Div., Columbus 16
Maumee Malleable Castings Co., Toledo 5
National Mall. and Steel Castings Co., Cleveland 6

PENNSYLVANIA
Buck Iron Company, Inc., Philadelphia 22
Erie Malleable Iron Co., Erie
Lancaster Malleable Castings Co., Lancaster
Lehigh Foundries Company, Easton
Meadville Malleable Iron Co., Meadville
Pennsylvania Malleable Iron Corp., Lancaster

TEXAS
Texas Foundries, Inc., Lufkin

WEST VIRGINIA
West Virginia Mall. Iron Co., Point Pleasant

WISCONSIN
Belle City Malleable Iron Co., Racine
Chain Belt Company, Milwaukee 1
Federal Malleable Company, West Allis 14
Kirsh Foundry Inc., Beaver Dam
Lakeside Malleable Castings Co., Racine
Milwaukee Malleable & Grey Iron Works, Milwaukee 46

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Today's high speed tools for drilling, tapping, milling, sawing and other metal cutting operations are better than ever. Through research and development, and new and better production methods, American toolmakers are constantly improving high speed steel tools to help you make better products . . . at less cost.

As a leading producer of high speed and other specialty steels, Universal-Cyclops continues to aid your toolmaker's efforts with its own aggressive research and development program.

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Corrosion Resistance of Metals—I

Abstracted by permission from Manual 700—A "Heat Exchangers," published by the Patterson-Kelley Co., Inc, East Stroudsburg, Pa. Some corrosive chemicals in the original tables have been omitted

Proper selection of materials for heat exchangers, chemical equipment, piping, valves, etc, depends upon their exposure to corrosion. Many forms of corrosive attack can take place — pitting, intergranular attack, and electrochemical reactions.

The accompanying tables give relative resistance of metals to electrochemical attack; that is, when a metal is surrounded by a polar liquid—one that conducts electricity. The tabulated values are supplied as a guide to selecting proper materials, with the understanding that electrochemical reactions are affected by variables such as temperature, concentration, contaminants, aeration, velocity, stresses, metal-surface conditions, purity of the metal, and presence of corrosion inhibitors.

If dissimilar metals are used in a structure exposed to a polar solution, galvanic attack occurs, because electric current flows between them as it does in a battery. One metal, the anode, will corrode by release of metallic ions to the electrolyte, but the cathode does not corrode. Metals are rated according to their galvanic activity. The galvanic series ranges (as tabulated) from magnesium, the most effective anode, to titanium as the least corrodible, or cathodic in nature. The distance between the metals in the galvanic series is a measure of the galvanic corrosion to be expected, when they are used in a structure in the presence of an electrolyte.

Galvanic Series of Metals (in sea water)

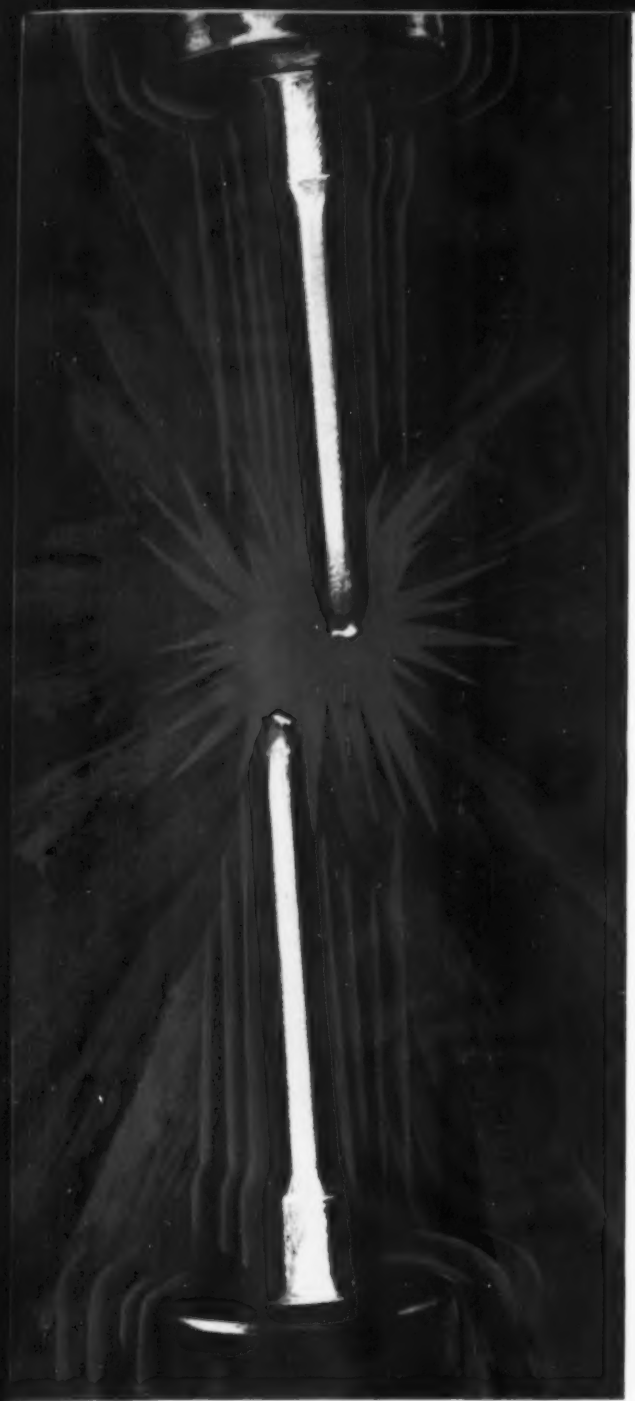
ANODE

Magnesium
Zinc
Aluminum
Steel, low carbon and alloy
Cast iron
Stainless steels (active)
Ni-resist
Muntz metal
Yellow brass
Admiralty metal
Red brass
Copper
Aluminum bronze
Cupro-nickel
Nickel
Inconel
Tantalum
Silver
Stainless steels (passive)
Monel
Hastelloy C
Zirconium
Titanium

CATHODE

LEGEND
A – Excellent
B – Good
C – Fair
D – Not Suitable
E – Explosive
I – Ignites
• – Information not available

	Concentration, %	Temperature, F	Carbon Steel	Copper	Red Brass	Muntz	Admiralty	Copper Silicon	90-10 Cupro-Nickel	70-30 Cupro-Nickel	Aluminum	304 Stainless Steel	316 Stainless Steel	Nickel	Monel	Inconel	Hastelloy	Titanium	Zirconium	Tantalum
Acetaldehyde	100	70	A	E	E	E	E	E	E	E	A	A	A	A	A	A	A	B	•	A
Acetic Acid (Aerated)	100	70	D	D	D	D	D	D	C	C	B	A	A	D	A	B	A	A	A	A
Acetic Anhydride	100	70	D	B	C	D	C	B	B	B	A	B	B	B	B	B	A	A	A	B
Acetone	100	70	A	A	A	A	A	A	A	A	A	A	A	B	A	A	B	A	•	A
Aluminum Hydroxide	10	70	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	•	•	B
Ammonia (Anhydrous)	100	70	A	A	A	A	A	A	A	A	A	A	A	B	A	B	B	A	•	A
Ammonium Chloride	10	70	D	D	D	D	D	D	D	D	C	B	B	B	B	B	B	A	A	A
Ammonium Sulfate	10	70	C	C	C	C	C	C	C	C	D	C	C	B	A	B	B	A	A	A
Aniline	100	70	A	D	D	D	D	D	D	D	D	A	A	B	B	B	B	A	•	A
Aroclor	100	70	B	A	A	A	A	A	A	A	A	B	B	A	A	A	A	A	•	A
Barium Chloride	30	70	B	B	B	D	C	B	B	B	B	B	B	B	B	B	B	A	A	A
Benzaldehyde	100	70	B	B	B	B	B	B	B	B	B	B	B	B	B	B	A	A	•	A
Benzene	100	70	A	A	A	A	A	A	A	A	B	B	B	B	B	B	B	A	•	A
Benzoic Acid	10	70	D	B	B	B	B	B	B	B	B	B	B	B	B	B	B	A	•	A
Boric Acid	10	70	D	B	B	B	B	B	B	B	C	A	A	B	B	B	A	A	•	A



"How Jessop Stretches Specialty Steels"

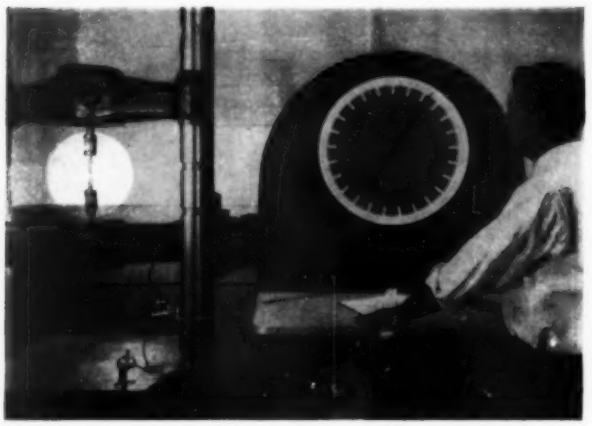
Robert Timko, Metallurgist

"**At Jessop,** tensile testing of specialty steels is carried out with far more than ordinary precision. It pays. It's one of the reasons our repeat business is so high.

"Based on a series of photographs, this drawing shows a specimen of type 304 annealed stainless steel bar at the climax of a tensile strength test. Moving apart, the heads of the tensile testing machine stretched the bar until it finally ruptured at 5500 psi above the spec."

In this Jessop metallurgical laboratory, top metallurgists using all types of modern testing equipment help us make certain you get *consistent* high quality in specialty steels. *Specify Jessop . . . and then relax.*

JMA 6708



Tensile testing machine in the Jessop metallurgical lab. Stretch, strain and then bang! The specimen of type 304 annealed stainless bar ruptured at 5500 psi above the spec. Tensile strength okay!

In the Jessop metallurgical lab, this tensile testing machine is one of many types of tools used to make certain you get *exactly* what you want in specialty steels.

Jessop Steel International Corporation · Green River Steel Corporation
Steel Warehousing Corporation, Chicago · Jessop Steel of Canada, Ltd.

JESSOP
STEEL COMPANY
Washington, Pennsylvania

Stainless, alloy, cast-to-shape, clad and forging steels, ground flat stock and other specialty steels

CIRCLE 257 READER SERVICE CARD

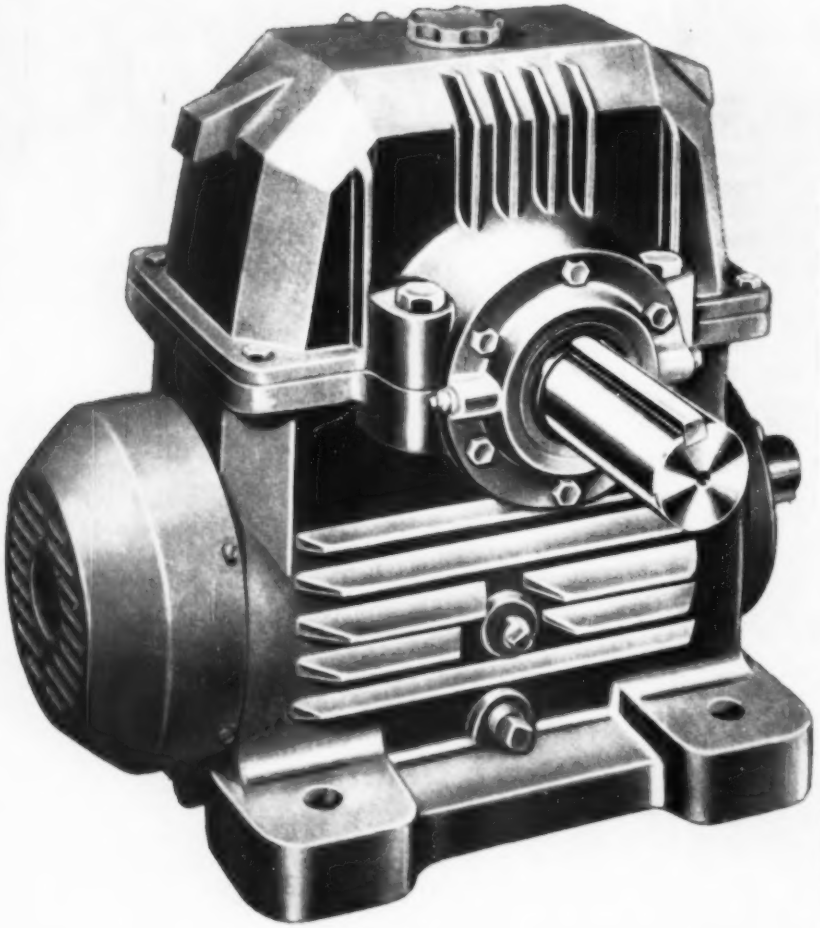
Corrosion Resistance of Metals—II

LEGEND
A – Excellent
B – Good
C – Fair
D – Not Suitable
E – Explosive
I – Ignites
• – Information not available

	Concentration, %	Temperature, F	Carbon Steel	Copper	Red Brass	Muntz	Admiralty	Copper Silicon	90-10 Cupro-Nickel	70-30 Cupro-Nickel	Aluminum	304 Stainless Steel	316 Stainless Steel	Nickel	Monel	Inconel	Hastelloy	Titanium	Zirconium	Tantalum
Butane	100	70	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	•	A	
Butanol	100	70	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	•	A	
Butyl Acetate	100	70	A	B	B	B	B	B	B	B	A	B	B	A	B	A	B	•	A	
Butyl Chloride	100	70	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	•	A	
Calcium Chloride	20	70	B	B	B	D	C	B	B	B	B	C	B	A	A	A	B	A	A	A
Calcium Hydroxide	10	70	B	B	B	B	B	B	B	B	D	B	B	B	B	B	B	A	•	A
Carbon Dioxide (Wet)	100	70	C	C	C	C	C	C	C	C	B	A	A	A	A	A	A	A	•	A
Carbon Tetrachloride (Dry)	100	70	B	B	B	B	B	B	B	B	B	B	B	A	A	A	B	A	A	A
Chlorine Gas (Dry)	100	70	B	B	B	B	B	B	B	B	C	B	B	B	B	A	B	I	A	A
Chloroform (Dry)	100	70	B	B	B	B	B	B	B	B	B	B	B	A	A	B	B	A	A	A
Citric Acid	20	70	D	C	C	D	C	C	C	C	A	C	B	B	B	A	C	A	A	A
Creosote	100	70	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	A	•	A
Dibutylphthalate	100	70	A	A	A	A	A	A	A	A	B	B	B	B	B	B	B	A	•	A
Dichlodifluoromethane(F-12)	100	70	A	A	A	A	A	A	A	A	A	A	B	B	B	B	A	A	•	A
Diethanolamine	100	85	A	B	B	B	B	B	B	B	A	A	A	A	A	A	A	A	•	A
Diethyl Ether	100	70	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	A	•	A
Diethylene Glycol	100	70	A	B	B	B	B	B	B	B	B	A	A	B	B	B	B	A	•	A
Diphenyl	100	160	B	B	B	B	B	B	B	B	A	B	B	B	B	B	B	A	•	A
Diphenyl Oxide	100	85	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	A	•	A
Ethanolamine	100	70	B	B	B	B	B	B	B	B	B	A	B	B	B	B	B	B	•	A
Ether	100	70	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	A	•	A
Ethyl Acetate (Dry)	100	70	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	A	•	A
Ethyl Alcohol	100	70	B	B	B	B	B	B	B	B	B	B	B	B	B	B	A	A	A	A
Ethyl Ether	100	70	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	A	•	A
Ethylene Glycol	100	70	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	A	•	A
Fatty Acids	100	400	D	D	D	D	D	D	D	D	A	D	A	B	C	B	A	B	•	A
Ferric Sulfate	10	70	D	D	D	D	D	D	D	D	D	B	B	D	D	D	A	A	•	A
Formaldehyde	50	200	D	B	B	D	B	B	B	B	C	B	B	B	B	B	B	B	•	A
Furfural	100	70	B	B	B	D	B	B	B	B	B	B	B	B	B	B	B	A	•	A
Glycerine	100	70	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	•	A
Hydrochloric Acid (Aerated)	38	70	D	D	D	D	D	D	D	D	D	D	D	D	D	D	B	D	D	A
Hydrofluoric Acid (Aerated)	40	70	D	C	D	D	D	D	D	C	D	D	D	D	C	D	A	D	D	D
Iodine	20	70	D	D	D	D	D	D	D	D	D	D	D	D	D	D	B	D	•	A
Isopropanol	100	70	A	B	B	B	B	B	B	B	B	B	B	B	B	B	B	A	•	A
Lactic Acid	50	70	D	B	B	D	C	B	B	B	D	B	A	B	C	A	A	A	A	A

DELROYD
SPEED REDUCERS

De Laval Announces All New Line of Single Reduction Speed Reducers



DELROYD
TYPE B
fan cooled
5" through 12"
center
distance
★

Send for this new 32-page Bulletin 3805 today.

New Delroyd single reduction speed reducers are available in a wide range of sizes and horsepower ratings. These worm gear units include centrifugally cast gears and fan cooling, and carry *the new AGMA ratings.*

DE LAVAL *Steam Turbine Company*
NOTTINGHAM WAY, TRENTON 2, N. J.

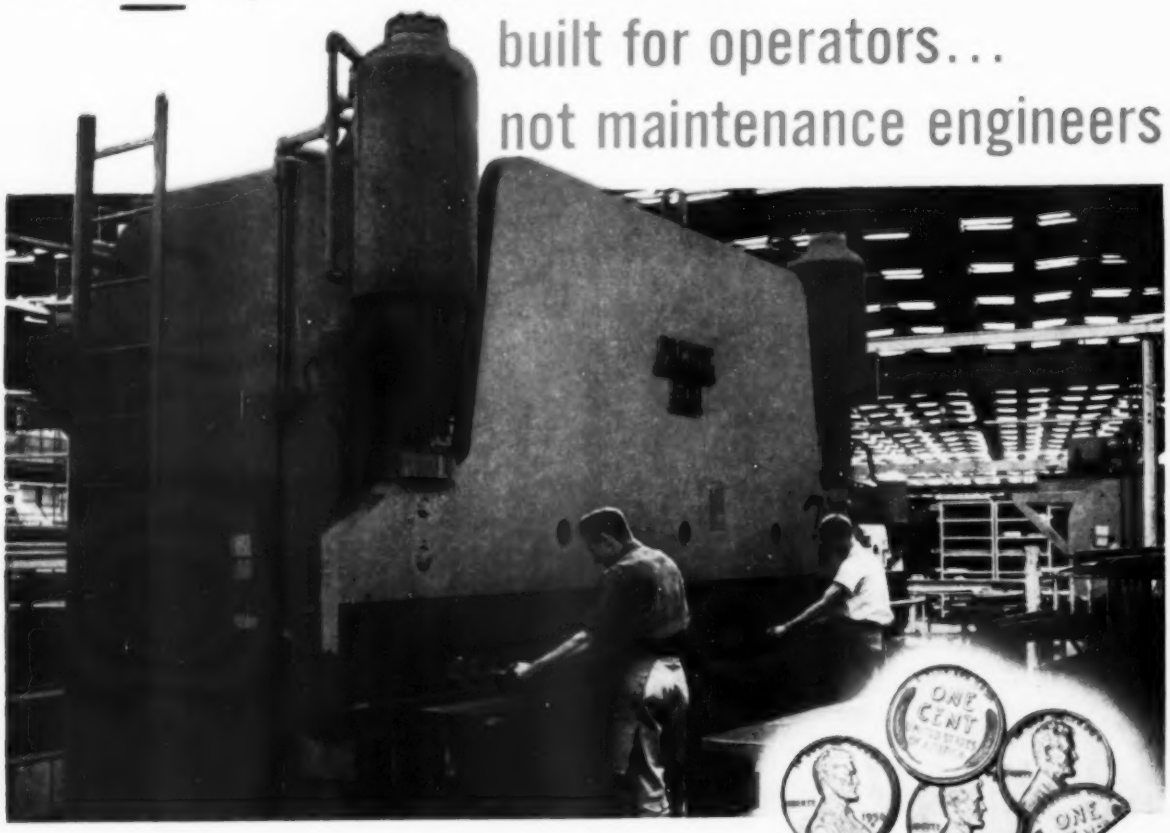
DL 479

Corrosion Resistance of Metals—III

LEGEND
A – Excellent
B – Good
C – Fair
D – Not Suitable
E – Explosive
I – Ignites
• – Information not available

	Concentration, %	Temperature, F	Carbon Steel	Copper	Red Brass	Muntz	Admiralty	Copper Silicon	90-10 Cupro-Nickel	70-30 Cupro-Nickel	Aluminum	304 Stainless Steel	316 Stainless Steel	Nickel	Monel	Inconel	Hastelloy	Titanium	Zirconium	Tantalum
Lithium Chloride	30	200	B	B	B	D	B	B	B	B	D	B	A	A	A	A	A	•	•	A
Lithium Hydroxide	10	200	B	B	B	D	B	B	B	B	D	B	B	B	B	B	B	•	•	A
Magnesium Chloride	30	70	B	B	B	D	C	B	B	B	C	B	B	A	B	A	A	A	A	A
Magnesium Hydroxide	10	70	B	B	B	B	B	B	B	B	D	B	B	B	B	B	B	A	•	B
Magnesium Sulfate	30	200	B	B	B	B	B	B	B	B	C	A	A	B	B	B	A	A	A	A
Methallyamine	100	70	C	B	B	B	B	B	B	B	B	B	B	B	C	B	B	B	•	A
Methyl Alcohol	100	70	B	B	B	B	B	B	B	B	B	B	B	B	A	B	A	A	A	A
Methylene Chloride (Dry)	100	70	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	•	A
Monochlorobenzene (Dry)	100	70	B	B	B	B	B	B	B	B	A	B	B	A	A	A	B	B	•	A
Monochlorodifluoro Methane (F-22)	100	70	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	•	A
Monoethanolamine	100	200	B	B	B	B	B	B	B	B	B	B	B	B	B	B	•	•	•	A
Naphthalene	100	70	A	B	B	B	B	B	B	B	B	A	A	A	A	A	B	B	•	A
Nickel Sulfate	10	200	D	B	B	D	B	B	B	B	D	B	B	B	B	B	B	B	A	A
Nitric Acid	50	200	D	D	D	D	D	D	D	D	D	B	B	D	D	D	D	A	B	A
Nitrous Acid	10	70	D	D	D	D	D	D	D	D	D	B	B	D	D	D	•	•	•	A
Oleic Acid	100	70	B	B	B	C	B	B	B	B	B	B	B	A	A	A	B	B	B	B
Oxalic Acid	10	70	D	B	B	C	B	B	B	B	C	B	B	C	B	B	B	D	B	A
Perchloroethylene	100	70	A	B	B	C	B	B	B	B	B	B	B	A	A	A	•	A	•	A
Phenol	10	120	B	B	B	B	B	B	B	B	A	B	B	B	A	B	A	A	•	A
Phosphoric Acid (Aerated)	50	200	D	D	D	D	D	D	D	D	D	B	B	D	D	B	A	C	D	B
Potassium Carbonate	40	200	B	B	B	B	B	B	B	B	D	B	B	B	B	B	B	A	•	A
Propylene Glycol	100	70	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	A	•	A
Pyridine	100	70	A	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	•	A
Sodium Acetate	10	70	D	B	B	B	B	B	B	B	C	B	B	B	B	B	B	B	•	A
Sodium Hydroxide	50	300	D	D	D	D	D	D	D	D	D	D	D	A	B	B	B	B	B	D
Sodium Sulfate	10	200	B	B	B	B	B	B	B	B	A	B	A	B	B	B	B	A	•	A
Sulfur Dioxide (Dry)	100	300	B	B	B	C	B	B	B	B	B	B	B	B	B	B	B	A	•	A
Sulfuric Acid (Aerated)	60	200	D	D	D	D	D	D	D	D	D	D	D	D	D	D	B	D	A	A
Trichloroethylene (Dry)	100	150	B	B	B	C	B	B	B	B	B	B	B	A	A	B	A	A	A	A
Turpentine	100	70	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	•	A
Vinyl Chloride (Dry)	100	70	A	B	B	D	C	B	B	B	A	B	A	A	A	A	A	A	•	A
Water (Fresh)	100	70	C	A	A	A	A	A	A	A	B	A	A	A	A	A	A	A	A	A
Water (Sea)	100	70	C	B	B	C	A	B	A	A	B	A	A	B	A	B	B	A	A	A
Xylene	100	200	B	A	A	A	A	A	A	A	B	A	A	A	A	A	A	A	A	A
Zinc Chloride	10	70	D	D	D	D	D	D	D	D	C	B	B	B	A	D	B	A	A	A
Zinc Sulfate	20	70	D	B	B	D	B	B	B	B	D	B	A	B	B	A	B	A	•	A

The one hydraulic press brake built for operators... not maintenance engineers



To all outward appearances many hydraulic press brakes may *seem* alike but that is where the similarity ends. Inside the PACIFIC is the most sensibly simple, patented level control system ever devised . . . only 6 microswitches and 2 relays provide the precise PACIFIC accuracy that no other hydraulic press brake can even remotely approach. Free of lineal variable differential transmitters, electronic amplifiers, photo-electric relays, amplidyne generators, complex hydraulic servo-valves, variable volume pumps and other complicated gadgets, PACIFIC hydraulic press brake can be kept in continuous operation by the ordinary plant maintenance man without the costly services of a professional hydraulic or electronic engineer from some distant factory. PACIFIC can be maintained for pennies per operating hour . . . only a fraction of the cost of the complicated machines.

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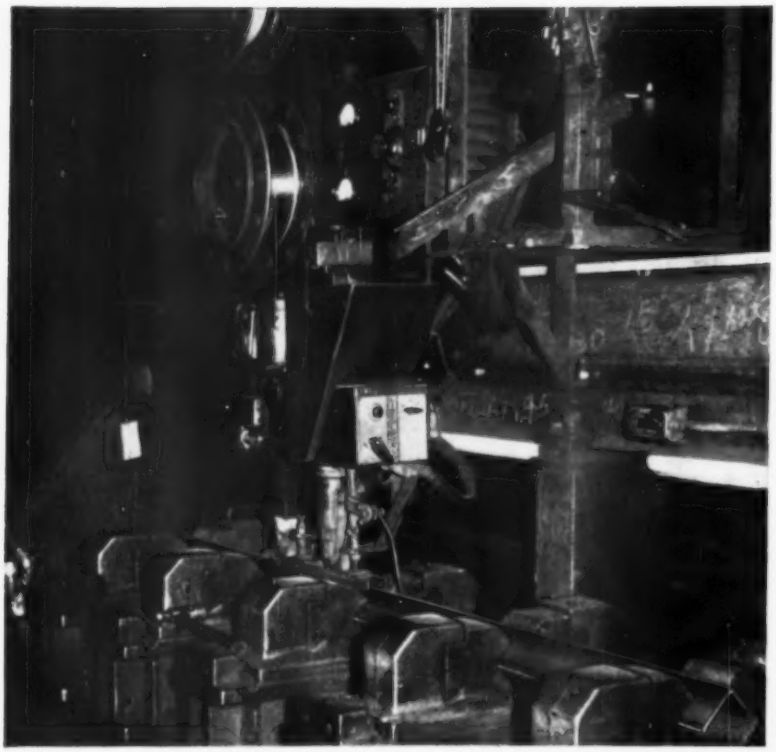


Four foot, ¼" box beam is positioned, welded and cleaned in 2½ minutes. Lincolnweld with Twinarc welds at 90" per minute.

TWINARC SIMPLIFIES WELDING... UPS FARM MACHINE PRODUCTION

The Krause Corporation has increased production on box beams 33⅓% with their Lincolnweld Automatic welder by adding a Twinarc attachment. This company in Hutchinson, Kansas, makes one-way plows, wheel-mounted disc harrows and chisels, self-propelled forage harvesters and other farm equipment.

The Twinarc attachment feeds two welding wires through a single submerged arc welding head, doubling the speed of welding with a single wire.

Krause fabricates the box beams from ¼" angles. The angles are put in a jig, clamped in position with hydraulic positioners. The Twinarc makes one pass on each of the two edge seams at 90 inches-per-minute.

Mr. Wilbur Thomas, Krause's Welding Foreman says, "The Twinarc not only welds faster, but higher currents make it possible to weld the angles without cleaning off light rust and oil which used to cause some imperfections when a single wire was used."

This application has proved so successful at The Krause Corporation that they are now installing their second Lincolnweld Automatic welder with a Twinarc attachment.

For help with welding procedures, or cost reduction ideas, call your Lincoln welding engineer today.

Wilbur Thomas, Welding Foreman, "Savings justified the purchase of a second machine."

Catalog Available

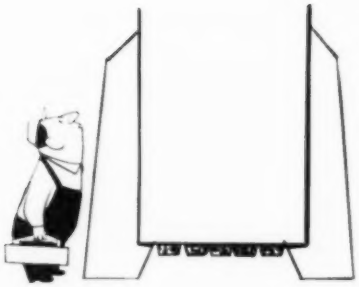
Complete information on Lincolnweld Automatic Submerged Arc welding equipment and accessories is contained in Bulletin 5200.1. A copy may be obtained by writing, on your letterhead to Lincoln.

LINCOLN ...USA

THE LINCOLN ELECTRIC COMPANY, Dept. 2037, Cleveland 17, Ohio

world's leading manufacturer of arc welders, ac motors and battery chargers.

Talking Shop...



Wan-Hu

WE'VE JUST LEARNED, belatedly, of what may have been the first attempt to put a man in orbit. About 1500 AD, the Chinese mandarin Wan-Hu, an enthusiastic student of rockets, had himself strapped into a sedan chair mounted atop 47 large rockets. Two kites were first sent aloft to tug at the sedan chair, then 47 coolies applied 47 torches to 47 fuses and ran for cover. When the smoke and confusion had cleared, Wan-Hu, sedan chair, kites and rockets all were gone. W D Mogerman, Inco's corrosion reporter, unearthed this tale for us from ancient books on rocketry. It is not clear whether Wan-Hu went into orbit—or may even still be there. But we can imagine the discomfort of sensitive astronauts at home and abroad if it turned out that the Chinese did it first—and during the Ming Dynasty.

Proverb

THERE IS no adequate defense, except stupidity, against the impact of a new idea.

The JETS

HAVE YOU heard about the Junior Engineering Technical Society? This remarkable organization was conceived by Prof L G Miller at Michigan State University in 1950. In less than a decade it has grown to more than 500 chapters in high schools in 41 states. Designed to develop an interest in engineering among high school students, the program includes an exposition of projects made by students and some scholarships, but the major emphasis is on assistance, counsel, and materials for the bi-weekly meetings of the chapters.

You might be interested in helping start a JETS chapter at the high school near you. Or your company might want to become a sponsor by donating funds, materials, or prizes. In either case, write to John Groomes, executive director, Box 589, East Lansing, Mich.

By Any Other

OBSERVANT READERS may have noticed a changed word on our cover. The field of this magazine is described as "metalworking manufacturing" rather than "metalworking production." Not that we have anything against the word production—quite the contrary. But we discovered some time ago that to many people production implies a narrower part of the manufacturing process than does the word manufacturing itself. Regular readers know that *all* the steps in making a metal product are our concern, and we want to make this fact as clear as possible to new readers right from the start. We changed the work in recognition of the popular meaning of the two ters. There isn't any change in our content. We're just trying to call a rose a rose.

Idea Outlet

THE CARTOON on this page reminds us that the pictures of people who supply the ideas that make up AMERICAN MACHINIST don't really appear in the magazine very often. But the ideas do, and the credit goes to the people responsible whenever possible. When you or anyone else in your plant does something of interest the editors of AMERICAN MACHINIST are panting to find out about it. And we are as near to you as the nearest telephone or mailbox.

Plastic Dip

AN OLD TRICK for protecting tools has been modified slightly at the Lockheed plant in Marietta, Ga. All drills over $\frac{1}{2}$ in., and all cutters, end mills, reamers, and taps are dipped into plastic as soon as they are returned to the tool crib from the plant floor. This is done whether the tools are to be returned to bins or to be sent to the tool repair shop. Damage is prevented in either case from contact with other tools in handling.

Lots of plants use such a plastic dip, but Lockheed's twist is to use a clear dip so that it is easy to read identification numbers through the coating. This makes it necessary to empty and refill the plastic melting pot every two weeks (they use Westcoat-Clear No. 202 and it tends to turn dark in about that time) but the cost of this is nominal.

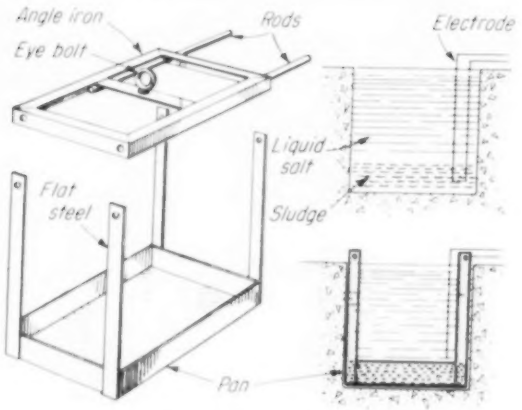
Reverse Thinking

PILSON W KELLY reminds us, writing in the current *Management Review*, that sometimes the easiest way to correct a bad situation is to reverse the element causing the trouble. He reminds us that George Westinghouse did not produce the first air brake. Dozens of methods to apply brakes by air pressure had been tried and had failed. He simply reversed the whole thing by inventing the first brake to be held *off* by air pressure against the action of simple springs. It made all the difference.

"Is that you dear? Did you know your picture is in the American Machinist."

Practical Ideas...

Pan Keeps Furnace Clean



Accumulated sludge formation in a salt-bath furnace reduces the useful depth of the working space. Consequently, this sludge has to be removed from time to time to restore the furnace to its full capacity, but the work involved is messy and time consuming. The liquid salt will first have to be transferred to another vessel before the sludge can be dug out.

Because most modern furnaces have removable electrodes, this inconvenience can easily be eliminated with a sludge pan. Kept emptied, it will insure full-working depth of the furnace at all times.

Little working time and inexpensive material are the only ingredients required in the construction of the pan and its lifting fixture. The pan is welded up from ordinary carbon-steel plate and provided with a flat-steel strap at each corner.

The lifting fixture is an angle-iron weldment, made to nest over the strap ends, and drilled to register with holes in the protruding straps. Two rods are used to join the two components while the tray is being lifted from or placed into the furnace. An eye bolt, balance located on top of the fixture, provides a convenient place to put the chain-hoist hook.

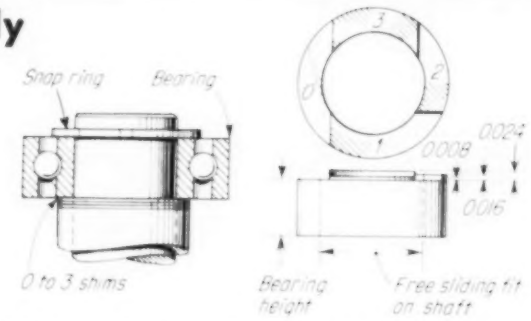
John Obreski, metallurgist, Monarch Machine Tool Co, Sydney, Ohio

Thickness Gage Speeds Assembly

Accumulative errors in a shaft assembly made it necessary to employ shims in the final mounting of a ball bearing. The shims were designed to minimize end play, caused by vibration, in stacked gears and spacers on the shaft. But, as the bearings had a snug fit on the shaft, it became quite a job to mount the bearing for the sole purpose of finding the number of shims required, after which it had to be removed to put the shims in place.

This work and wasted time has been eliminated since I designed the gage shown. It provides four steps; one equal to the height of the bearing, plus 0.008, 0.016, and 0.024-in. landings. Three shims of 0.008-in. thickness were allowed by our product designer to fill the space unoccupied by the bearing between the shoulder of the shaft and a snap ring.

As shown in the sketch, the gage was made in the shape of a heavy spacer collar with a bore to slip fit on the shaft. The length of gage was finished on the surface grinder to 0.024 in. longer than the bearing used and marked 3. Section marked 0 was then ground down to the exact length of the bearing and



in the same setting, section 2 was finished to 0.016 in. plus. Finally, the gage was rotated 90° to grind face 1 to 0.008 in. above bearing height.

When all the parts have been assembled, instead of mounting the bearing, the gage is slipped onto the shaft. It is then an easy matter to sight check (coordinating one of the gage steps with the snap-ring groove) to determine what shims are required and where.

B J Learitt, Lincoln, Nebr

Stamp Held in Hammer Speeds Inspection Marking

Much time and effort will be saved in stamping inspection symbols and identification marks on finished metal parts if the stamp is mounted in the head of a hammer. Work can then be marked with a blow of the hammer in less time than it takes an operator to hold the stamp in position with one hand while striking it with a hammer held in the other.

The tool was made by torch annealing the head of an inexpensive ball peen hammer without removing it from the handle. It was then drilled and reamed about $^{3}/_{4}$ in. deep into the face of the head. A smaller hole was drilled and tapped into the side and fitted with a headless setscrew.

The shank of the stamp was similarly annealed and turned down to fit into the hole in the hammer head. Stamp was then inserted, positioned, and locked with the setscrew.

H J Gerber, Stillwater, Okla

Combined Actions of Punch and Die Overcome Springback

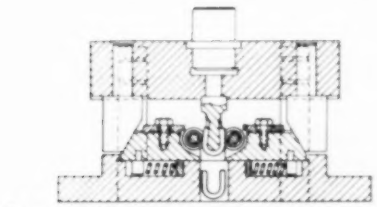


Fig 1

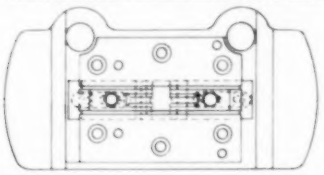


Fig 2

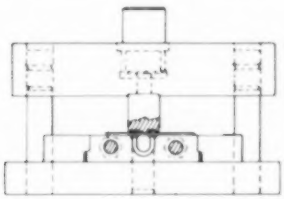


Fig 5

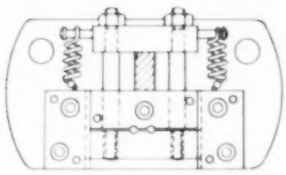


Fig 6

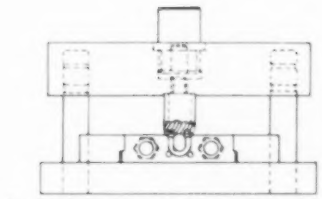


Fig 3

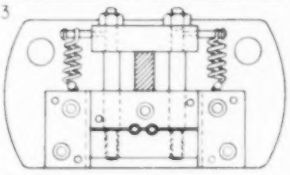


Fig 4

Flanged

Riveted

One of the most common problems in planning the construction of a bending die is how and where to make allowances for springback. In each case, material used, shape of part, and various other factors must be taken into consideration if the die design is to be successful. If these rules aren't followed, a second (corrective) operation and an added expense may be necessary to make part passable.

At Fig. 1 in the drawing a U-shaped part is shown being formed over a punch that is constructed to permit the required over bend. This is accomplished by the die which consists of two hardenend grooved rollers mounted in sliding blocks. Precut round-rod blanks are nested in the grooves of these rollers and between adjustable stops on top of the sliding blocks.

The blank is bent into a U-shape as the punch begins its down stroke. At the end of the stroke, the sliding blocks are brought closer by cams set in the punch holder. This action gives the part that extra squeeze necessary to produce parallel legs. The extent of the squeeze is controllable by the stroke of the ram.

On the upstroke, the blocks return to open position aided by compression springs. At this stage the part opens to its correct shape and slips off the punch.

This part is used riveted to a sheet-metal detail and must therefore have its legs upset to form flanges. The upsetting is done with punch and die shown in Figs. 3 and 4. The parts are loaded and gripped between two jaws, the back jaw stationary and the front one activated by a cam monted on the punch holder in back of the punch. This arrangement assures a firm grip on the part before the punch forms the flange.

To change from the flanging to the riveting operation, it is only necessary to switch the punches. See Fig. 5. The same die and punch holder with cam can be used for both operations.

Hjalmar Dahl, Upplands Vasby, Sweden

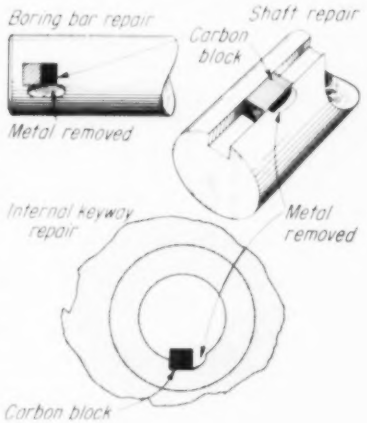
Welding Repairs Aided by Carbon Insert

Machining time required to clean up a job after it has been repaired by welding can, in many cases, be reduced with carbon fillers. When used to restrict the weld overflow in the keyway of a bore, a cleanup cut through the bore is usually all that's needed to restore the welded part to service.

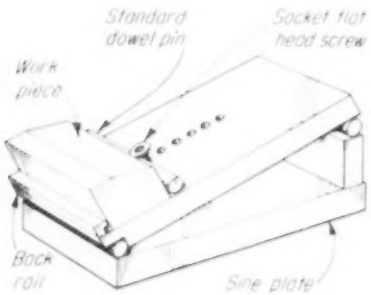
Repairs on a strained tool hole in a large boring bar, or on a torn shaft keyway can be simplified with carbon inserts. A careful filing, after the weld has cooled, is all you have to do to finish a boring bar. And the same treatment is sometimes enough to permit reassembly of a shaft that has been welded.

Old electric-motor brushes, when large enough, make good filler pieces, otherwise, carbon can be bought in round, square, and rectangular forms. A filler is prepared by either filing or grinding to fit the keyway or tool hole. Before it is inserted, some of the metal in the ruptured area is removed to insure a complete weld deposit. Acetylene method of welding is preferred for most jobs because it doesn't give you the air-hole producing slag to contend with.

J McQueenie, Ayrshire, Scotland



Practical Ideas...



A Work-Holding Kink

Holding a piece to a sine plate for surface grinding can sometimes get rather involved. It needn't, and here is a device that is both simple and effective.

First, all you'll need to do is to drill and tap a series of holes in your grinder sine plate. Then, get yourself a flat-head screw (preferably socket head) and a few assorted-size dowel pins.

When you've placed the work against the back rail of the sine plate, you can quickly select a hole that will allow the screw head to just clear the work. This is the hole from which you get your clamping pressure when an appropriate-size dowel is placed under the screw head as shown. The wedging action of the head angle causes the dowel to force the work against the back rail.

Jack A McIntyre, Elmira, NY

New Uses for End-Mill Containers

We've found there's double duty in those little end mill containers most shops throw away. We used to throw them out too, but now the two-piece, cylindrical containers have taken on an impressive roster of jobs in our shop; maybe you can add a few more.

Use them for storing talc, for protecting small carborundum stones, or for keeping track of easily lost toolbox items like taps, needles, etc.

Keep your brushes clean and separated by mounting them on dowel handles which are pressed or glued into the container body. Use the top as a cap, for storage.

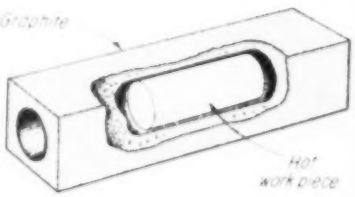
Perforate a cylinder with $\frac{1}{8}$-in. holes, and fill it with camphor crystals. You'll find it an effective rust preventer which easily fits into a corner of your toolbox or drawer.

Drill a hole in the top of a container and you've made a piston-cylinder blower that you can use where a blast of compressed air might do damage by scattering dust or chips.

Take an old hacksaw blade, grind it to a knife edge, and insert it in a dowel inside one of the containers to make a handy pattern knife. An old drill, groud to a point, can be made into a scriber in the same way. Watch that you grind to size and sharpness slowly, with frequent water quenching, to retain hardness.

If you're like us, soon you won't be able to find enough of the little containers.

Norman Fried, Los Angeles, Calif



How to Minimize Distortion During Heat Treating

We use a small furnace (6 x 6 x 9 in.) for hardening our small tool-steel parts, but have found that the air coming in causes scale to form on the parts being hardened. As a result of this oxidation, the parts come out one or two thousandths undersize. Parts would also distort during the quenching because of the scale causing uneven heat transfer from the work to the oil.

This problem has been solved by encasing the parts in a graphite or carbon block while in the furnace. When hardening a $\frac{1}{2}$-in. pin, for example, I use a block with a $\frac{5}{8}$-in. hole to sheathe it during the heating period. At the end of this time, I remove the block with the part in it and by tilting the block above the oil, the part slips out and is quenched without heat loss or exposure.

The parts come out of the oil with practically no size change or distortion and with even hardness. A little of the graphite wears away each time a block is used, the holes get larger, but they last a long time and their initial cost is low.

Jacob H Sperman, Brooklyn, NY

Hjalmar Dahl
Upplands Vasby, Sweden

WON

$25 **In addition to regular payment for his idea:**

RUBBER-NOSED PUNCH EXPANDS AND CURLS CUP

in the July 13, 1959 issue

An extra $25 will be paid for the best Practical Idea in each issue of *American Machinist*. Selection of the winner is made by a group of our readers.

PAYMENT—$25 in addition to regular rates for the items published to be paid as soon as reader votes are received—usually three to four weeks after the date of issue. The winner will also be announced in these pages as soon thereafter as practicable.

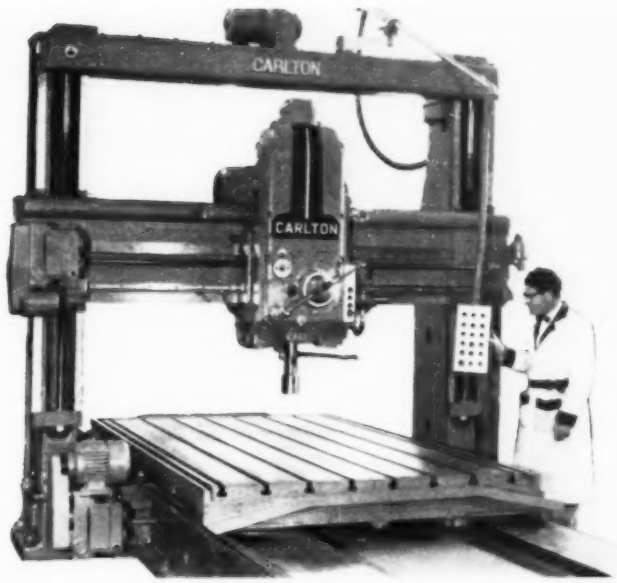
JUDGES—A group of 200 *American Machinist* readers is asked to select preferred articles in each issue. The group is a true cross-section of all readers, and changes entirely each time. Their votes, in addition to guiding the editors, select the best Practical Idea. If at any time their votes result in a tie, $25 will be paid to each co-winner. Decision of the readers will be final in each case.

REQUIREMENTS—Only items in the Practical Ideas pages are eligible, and they must be submitted directly by the originator. Do not worry about your shortcomings as a draftsman, photographer, or author—every item will be edited in accordance with *American Machinist* standards and suitable illustrative or explanatory material added where needed. Readers will judge only the finished product—in terms of its usefulness to them.

WHO MAY ENTER — Anyone may enter except employees of the McGraw-Hill Publishing Co, Inc, and those of advertising agencies or departments. Suggest to your employees that they submit ideas.

HOW TO ENTER — Send all entries to "Practical Ideas Editor," American Machinist, 330 West 42nd St, New York 36, N.Y.

New Shop Equipment
Materials and Parts



Carlton Planer-Type Drilling Machine Has Extra-Large Automatic Positioning Table

Planer-type drilling machine introduced by Carlton is said to have the largest automatic positioning table for a machine of this type. It measures 72 x 126 in. Workpieces can be located for drilling, reaming, boring, tapping, and milling either by pin bar spacing, vernier and rules, or tape or manual numerical control.

With numerical control, the table can be positioned to ±0.0002 in. When tape control is used, positioning is done through precision racks and pinions with read-out unit for locating the spindle, which is separate from the driving units for the table and head. The pin-bar unit features pin override control, allowing operator to override the pins without having to remove them from the bar.

The drilling head, powered by a 20-hp motor, has 36 spindle speeds and 18 feeds.

Carlton Machine Tool Co, Spring Grove Ave and Meeker St, Cincinnati, Ohio

MORE DATA? Circle 51, inside back cover

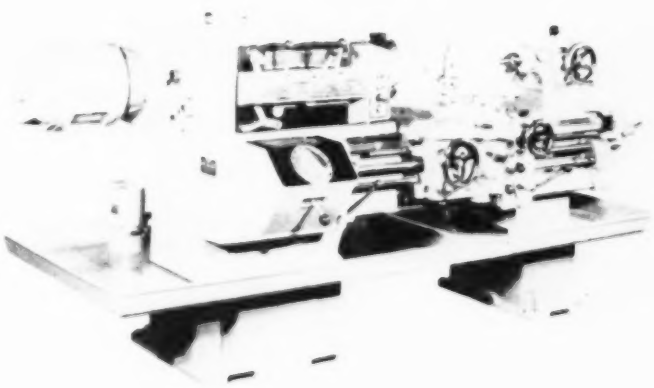
Etch-Resisting Plastic Coating Designed for Chem Milling Use

A light sensitive, etch-resisting plastic coating material has been announced by Kodak for use in chemical milling. Called Metal-Etch Resist, it resists all commonly used acids, alkalis, and electrolytes and can be used on steel, aluminum, titanium, nickel, magnesium, and other metals.

The plastic material is sprayed, rolled or painted on the metal surface under safe lights then exposed to high-intensity illumination in those areas which require protection from etching solutions. Masking can be done with a photographically prepared line negative corresponding to the pattern desired. After treatment with developer, the light exposed areas will resist the action of the etching solution. It is said that atmospheric changes do not affect exposure times. List price is $200 for a five-gallon container, $11 for one quart.

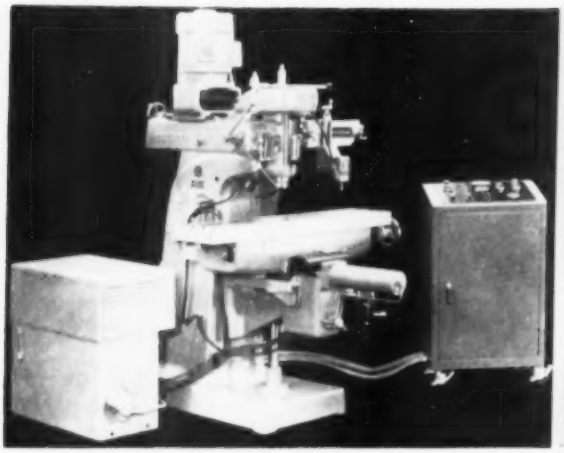
Eastman Kodak Co, Rochester 4, NY

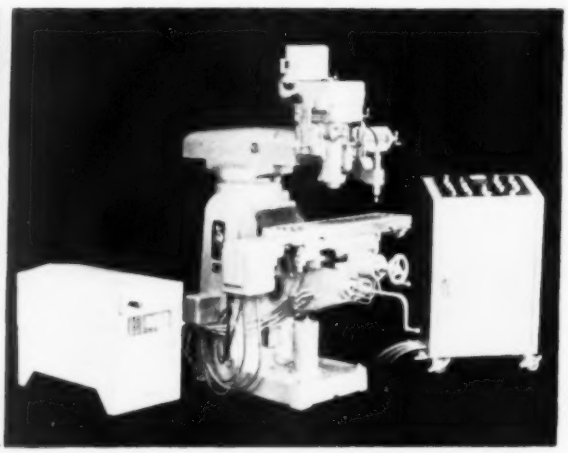
MORE DATA? Circle 52, inside back cover



REDESIGNED CLEARING LATHE has increased horsepower and spindle speeds and an enclosed gear box. Designated a 2013 lathe, the machine has a 22½ in. swing over bed and a 13¾ in. swing over carriage. Micrometer cross-feed threading stop and two-speed tailstock spindle traverse are standard equipment. *Clearing Div of U S Industries, Inc, 6499 W 65th St, Chicago 38, Ill*

MORE DATA? Circle 53, inside back cover





Millers Combine Electronic Tracing With Hydraulic Feed

Two new Gorton automatic milling machines, a three-dimensional duplicator and a production profiler, use a combination of electronic tracing and hydraulic power feeds.

Advantages of electro-hydraulic tracing include: The small cartridge-type tracer head provides excellent visibility and access to deep cavities because it has only one electrical cable instead of many hydraulic fittings, hoses, and controls. No heat is generated within the tracer head and no normal variation in room temperature will affect its operation.

Tracer spindle has a new style of $^{3}/_{8}$ in. collet-type nose. Because of the light stylus pressure (4 to 8 oz, depending on machine) a soft master can be used. A deflection meter, mounted on the control console, can be used to provide a direct reading of tracer deflection, enabling the operator to eliminate trial-and-error test cutting.

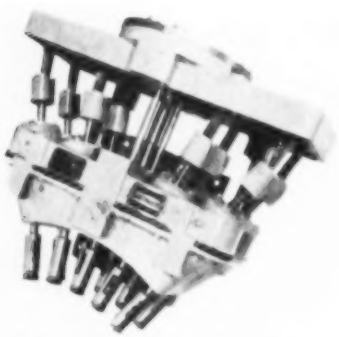
The 180° tracer (right), Model 1-22 Mastermil, is equipped with a device called area control which is said to approach the advantages of numerical control. It eliminates non-productive over-runs when working shapes with irregular peripheries. Power feed range is from $^{1}/_{4}$ to 60 ipm. Distance from tracer spindle to cutter spindle is $12^{1}/_{2}$ in. min, 25 in. max. Distance from spindle to table top ranges from 0 to $16^{7}/_{8}$ in. Longitudinal table feed is $21^{1}/_{2}$ in. Cross table feed ranges up to $9^{1}/_{2}$ in.

The 360° profiler, Model 9-J vertical mill, has a tracer sensitive to pressure from any direction within a 360° circle. Maximum longitudinal or cross feed is 30 ipm. Spindle to tracer distance is 13 in. min, $26^{1}/_{8}$ in. max. Distance from spindle to table top ranges from 0 to $17^{3}/_{4}$ in. Longitudinal table feed is $30^{1}/_{8}$ in. Cross table feed is 10 in.

Both machines have spindle speeds up to 45,000 rpm and control consoles that are completely transistorized. They can hold tracing tolerances of 0.001 in.

George Gorton Machine Co, Racine, Wis

MORE DATA? Circle 54, inside back cover



Drillhead Drills Angular and Straight Holes Simultaneously

Fixed center, ball-bearing, angular type drillhead drills holes at an angle at the same time that holes are being drilled parallel to the direction of machine feed. Ten spindles are spaced equally in two rows. To permit drilling hole radially, each pair of spindles is at an 11-degree angle with the adjacent pair. An included angle of 44 degrees exists between the pairs of outside spindles.

In operation, the main body of the head remains stationary while the spindles are fed into the work by the upper casting attached to the drilling machine. The head contains two guide rods and a machined pad to provide adequate support.

Thriftmaster Products Corp, 1021A N Plum St, Lancaster, Pa

MORE DATA? Circle 55, inside back cover

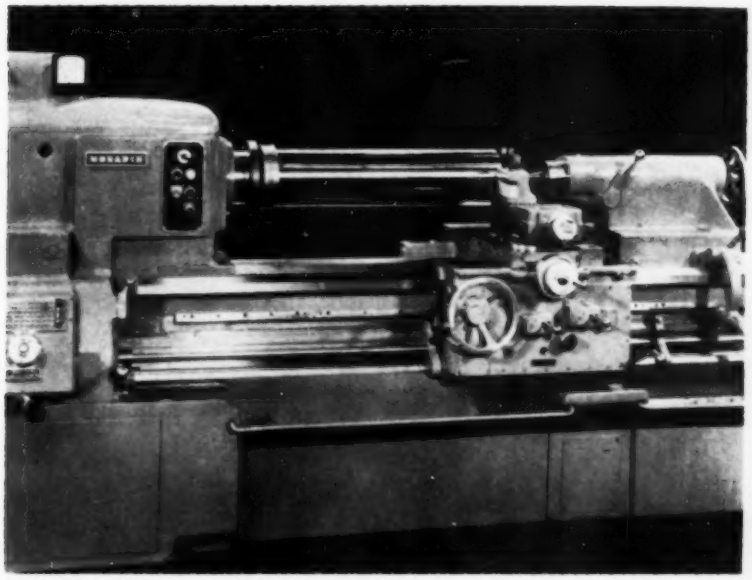
Series of Cold Finished Steel Bars Available in Five Grades

Century Series offers a wide choice in the ratio of machinability to strength and toughness. They have a minimum yield strength of 100,000 psi with resultant higher hardness and wear resistance. High strength, stress relieved bars provide good mechanical properties, excellent machinability, and dimensional stability. They are arranged on a sliding scale of sulfur content ranging from 0.24/-0.33 down to 0.050 max.

The five grades are identified as C1144, C1141, C1151, C1050, and C1045. Republic indicates that C1144, which has the highest sulfur content, would be recommended for parts requiring the highest machinability qualities, while C1141 and C1151, both lower in sulfur, would serve best where maximum machinability is not required. Grades C1050 and C1045, with a very low sulfur content, should be specified where machinability is of minor importance compared to strength and toughness.

Republic Steel Corp, 1405 Republic Bldg, Cleveland 5, Ohio

MORE DATA? Circle 56, inside back cover



New Monarch Series 62 Lathe Designed To Produce Fine Finishes Above 2000 sfpm

Designed to finish-turn rolls, cylinders, tubes, and similar parts to a critical microinch finish at speeds above 2000 sfpm, this Series 62 lathe eliminates or drastically reduces grinding and polishing time, according to the manufacturer. Taper is held within 0.00025 in., concentricity to less than 0.0005 in.

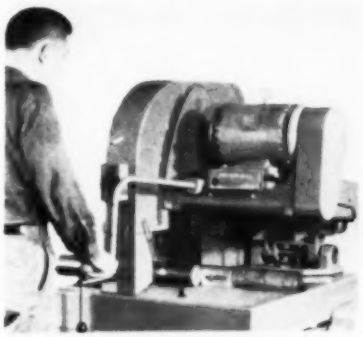
Swing over bedways is 25 in., swing over cross-slide is 16 in. The basic machine has a center distance of 72 in. but center distances of 96 and 120 in. can also be supplied.

Model 2516 has a variable speed drive direct to the spindle through a Poly-V belt. The effect of gearing on the surface finish is eliminated because there are no intermediate shafts or gears in the headstock. Variable spindle speeds can be selected over a constant torque range of 100 to 2200 rpm. A four-way power traverse is standard equipment. Adjustment of the tool can be made in increments of 0.0001 in. Bed alignment is within 0.00025 in. over 36 in.

In one application, hydraulic cylinder tubes are turned at 1500 sfpm to a 20-25 microinch finish. Another use is the diamond turning of copper plated rotogravure cylinders to a 6 microinch finish. Polishing time is said to be cut as much as 2 to 3½ hours per cylinder. Heavy-built-in anti-friction tailstock provides rigidity necessary for high finish results.

Monarch Machine Tool Co, Sidney, Ohio

MORE DATA? Circle 57, inside back cover



Oscillating Dry-Abrasive Cutting Machine Cuts 4-in.-Thick Solids

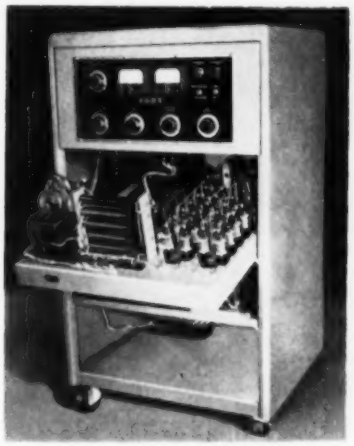
Model 2-A Sever-All cutting machine has the capacity to cut practically all ferrous and non-ferrous metals up to 4-in. solids, 5½-in. pipe or tubing, 6 x 1-in. flat stock, 6-in. angle iron, and 8-in. channels.

Power-driven wheel oscillation enables the unit to sever large cross-sections of the material with a fine quality of cut. In addition, oscillation reduces the arc of contact between the wheel and the work, provides faster cutting, reduces operator fatigue, and increases wheel life. Cutting pressure is applied by the operator through a hand-operated lever located to the right of the abrasive wheel.

Equipped with a dual-voltage 10-hp special high torque motor and a 20 x ⅛ x 1-in. cutting wheel, the machine has a cutting rate of 2 to 3 sec per sq in. of metal. It operates on a 220-v, 2-phase, 60-cycle power supply and can be adapted for a 440-v supply. A wide variety of workholding attachments are available.

Allison - Campbell Div. American Chain and Cable Co, Inc, Bridgeport 2, Conn

MORE DATA? Circle 58, inside back cover



Elox Power Supply Boosts EDM Metal Removal, Gives Finer Finish

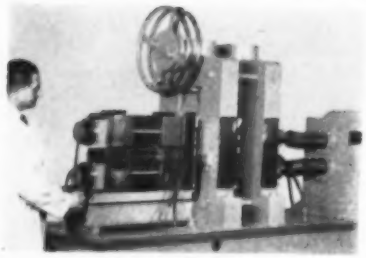
Reported to be the finest vacuum-tube power supplies available, the new Elox NPS power supplies use 75% less tubes, are less expensive, and are cheaper to operate than older models. Machining rates are boosted up to six times over previous units and the finish available is as much as three times as fine. (A 45-amp NPS finish is equal to a 15-amp finish from an older power supply.) Building-block plug-in design permits easier maintenance and service of these units.

These power supplies can be sectionalized into split output sections for multiple electrode operation. A 100-amp unit can be split into four 25-amp sections. Units are available in 15, 30, 60, 100, 200, 400, and 1000-amp sizes (and larger on special order). The NPS 30 (illustrated) is 30 in. wide, 26 in. deep, 54½ in. high, and weighs 575 lb.

Several new control circuits have been added including a dual control servo feed system and a roughing finishing selector switch in addition to the standard selector switch. Bulletin 704.05 available.

Elox Corp of Michigan, 1830 Stephenson Highway, Troy, Mich

MORE DATA? Circle 59, inside back cover



Combination Rolling Mill Processes Nuclear Metals

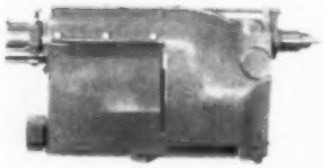
Heavy-duty, high-precision 2-high/4-high unit has been developed for application in nuclear metals production and research work. Major feature of the machine is its complete enclosure in a glovebox to allow processing of alpha-active pyrophoric materials, such as plutonium fuel elements.

In order to facilitate remote control operation within the glovebox enclosure, mill is equipped with a semi-automatic roll-changing device comprising a sliding way, quick-disconnect screwdown, universal spindle support, and pull-off oil lubrication lines. Entire roll assembly may be moved into or out of the mill by turning a handwheel; roll changes can be made within a few minutes.

Machine is operated in either a 6 x 8-in. 2-high setup or a 1½ and 6 in. x 8-in. 4-high setup. The 2-high arrangement is used for either hot or cold breakdown rolling of plate and sheet; grooved rolls are also available to process rounds, squares, and other shapes. In the 4-high setup strip is cold-finish rolled to gages as thin as 0.001 in. maintaining a 5% tolerance.

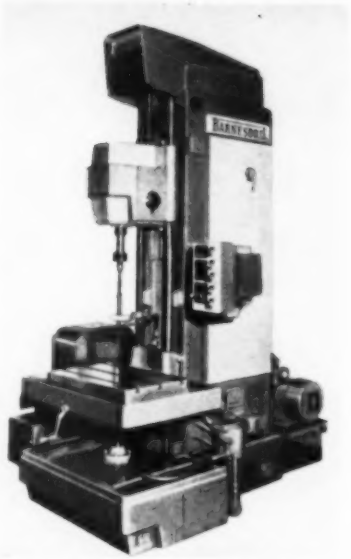
Loma Machine Mfg Co, 11½ E 32nd St, New York 16, NY

MORE DATA? Circle 60, inside back cover



AUTOMATIC DRILLING UNIT, Model 603, has a new base casting which permits shorter mounting dimension. There is a key slot on the center line for easier setup and an NEMA motor is used instead of the special motor previously required—*Electro Mechano Co, 241 E Erie St, Milwaukee, Wis*

MORE DATA? Circle 61, inside back cover



Honing Machine Equipped With New Electric Hone Expansion

Model 244 honing machine, designed to hone bores from ½ to 6 in. diameter, features compact design and simplicity of controls. A sizing unit holds bore-to-bore size consistency to 0.0002 in.

A new electric hone expansion unit gives infinite hone feed adjustment without the tubes and rectifiers required in electronic controls. Rapid expansion, rapid collapse and automatic compensation for stone wear are electrically controlled. When limitation of stone wear is reached, lights on the control panel warn the operator, and interlocking controls prevent starting a new honing cycle until new stones have been inserted.

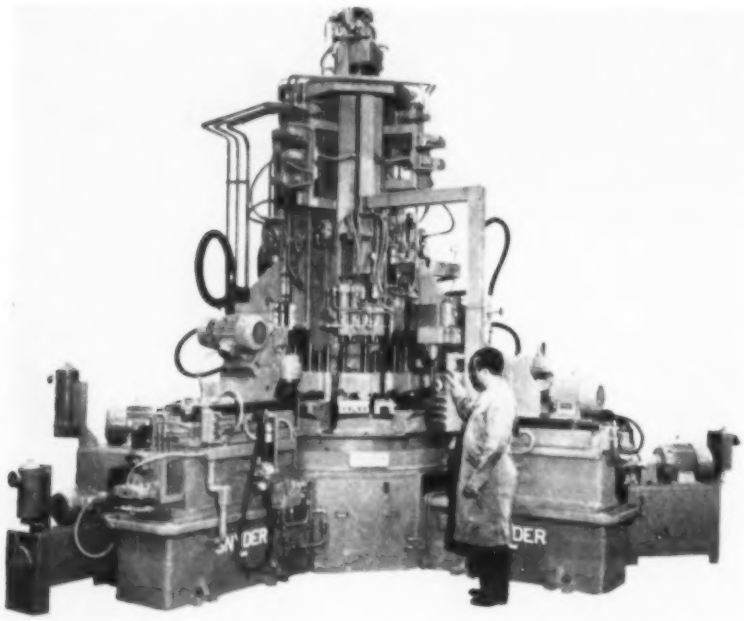
The machine is available with one or two spindles in a choice of three stroke lengths. Stroke length is controlled by a dial mounted on the rear of the control panel, and the four-speed transmission is controlled by a knob on the right side of the spindle head. The accurate stroke permits short stroking at any point in the bore, and the machine is particularly suited for honing ported bores. Air counterbalance insures smooth reversal of the stroke.

A 30-gal coolant reservoir is an integral part of the base. Power for spindle drive is provided by a 5-hp motor, with a separate 3-hp motor powering hydraulic reciprocation.

Bulletin Sal-H-112 available.

Barnes Drill Co, 850 Chestnut St, Rockford, Ill

MORE DATA? Circle 63, inside back cover



SIX DIFFERENT CAST IRON FUEL PUMP COVERS are milled, drilled, spotfaced and tapped on this 16-station center-column machine. Production rate is 81 cast iron parts per hour at 100% efficiency. Machine can process the same parts made of aluminum—*Snyder Corp, 3400 E Lafayette, Detroit 7, Mich*

MORE DATA? Circle 62, inside back cover

Drill Point Grinder Grinds Regular, Formed, Split Points

Drill point grinder introduced by Morse Twist Drill will grind conventional, formed or split points on a production basis. A high production rate is made possible by a V-rest drill holder which eliminates loading or adjusting bushings, jaws, or collets. According to the manufacturer, an average operator can grind over 450 No. 40 drills per hour.

Other features include: a calibrated swivel fixture that grinds conventional points with included angle of 118 to 150° and provision to point all drill sizes from 1/16 to ½ in. dia up to 6 in. long. Additional fixtures are available for angles of less than 118° and for extending the drill-length range to 12 in. Attachments are available for split-pointing and heli-centric pointing at production rates.

All grinding is done wet using an integral pump. All wear parts are hardened and ground, and the cartridge type wheel is interchangeable. The unit is 2 ft wide, 3 ft deep, and 4 ft high. It has a ½-hp, 220/440 v, 3 phase motor.

Morse Twist Drill and Machine Co. New Bedford, Mass

MORE DATA? Circle 64, inside back cover

Cutoff Tool for Turret Lathes And Automatic Screw Machines

Non-Flex tools are made in four sizes for use on bar stock of 2½, 3½, 4½, and 6-in. max diameters. Heavy, hardened steel support is located directly below the cutting tip. This provides extreme rigidity, permitting the use of any grade of carbide or Tantung. Because of rigidity, considerably greater speeds and feeds are possible than can be obtained with brazed carbide or HSS tools. Both holders and blades are precision ground to an accuracy of 0.001 in all dimensions, permitting any number of blade changes without losing original setting.

In tests, 2-in.-dia cold rolled steel solid bars have been cut in 5 seconds, and at lower speeds and feeds over 600 pieces have been cut off between tool grinds.

General Machine Co. Emmaus, Penna

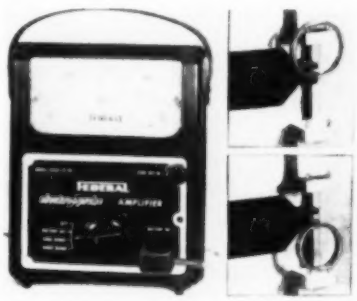
MORE DATA? Circle 65, inside back cover

Portable Pneumatic Grinders Available in New Series

Series 904 includes 6-in. heavy-duty horizontal grinders, wire brushers, and horizontal buffers. Choice of three speeds is furnished in the grinders and brushers, 9000, 7200, or 6000 rpm (free speeds). Speeds for the buffers are either 9000 or 6000 rpm. Either lever, straight, or grip-type handles may be specified.

Thomas C Wilson, Inc. 21-11 44th Ave. Long Island City 1, NY

MORE DATA? Circle 66, inside back cover



Electronic ID-OD Gage Designed For Bearing Races, Small Parts

Electronic ID-OD gage measures inner or outer diameters accurately without remastering and provides enough magnification to permit size classification in categories of 0.0001 in. Designed primarily for ball track diameters of bearing races, it can also be adapted for measuring other small parts.

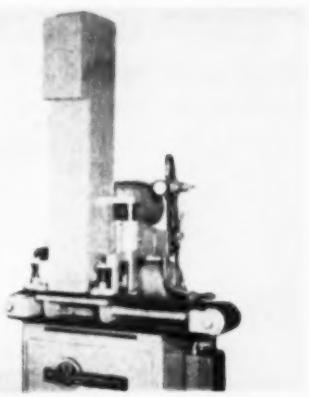
The gage uses an electronic measuring system operated by extremely light gaging pressure, eliminating the chance of part distortion. Model illustrated is adjustable and furnished with an auxiliary set of jaws to cover all bearing sizes between ⅛ and 1½ in.

Ball track OD of the inner race is measured by placing the part on the lower platform (bottom inset) and moving the fork lever to force the ball-tipped measuring contact downward to seat the piece. The lever is then released so that only 2.5 grams of gaging pressure is applied. Gaging contacts are arranged so that a chord is measured with the gage compensated for readout in terms of actual diameter.

For ID measurement the part is seated between the gaging tip and the ball rests of the upper platform (top inset) by similar movement of the yoke lever. The gage head is precisely positioned behind the plate of the fixture so that the end of the lever-type contact protrudes sufficiently to be in exact alignment with the ball rests.

Federal Products Corp. Providence 1, RI

MORE DATA? Circle 67, inside back cover



Lowcost Abrasive Belt Finishing Machine Handles 3-in.-Thick Parts

Lowcost Model JC Acme abrasive belt finishing machine for performing flat grinding, deburring and polishing operations is equipped with a 6-in. wide abrasive belt and will handle parts having stock thicknesses up to 3 in.

Unit has a motorized conveyor belt that carries the work under spring-loaded hold-down rollers and

the abrasive belt contact wheel. Multiple head assemblies can be mounted in tandem along one long conveyor belt to perform high production progressive finishing operations, or they can be used with rotary tables.

Features include pneumatically tensioned abrasive belt, positive manual or automatic belt tracking, micrometer grind pressure adjustment, V-belt drive to permit abrasive belt speed changes, and infinitely variable control of conveyor belt feed. The machine can be equipped for either wet or dry finishing.

Working height of the machine is 34 in. The abrasive belt is driven by a 3-hp motor and the feed drive by a ¼-hp motor. Feed range is 15 to 60 fpm.

Acme Mfg Co, 1560 E Nine Mile Rd, Detroit 20, Mich

MORE DATA? Circle 68, inside back cover

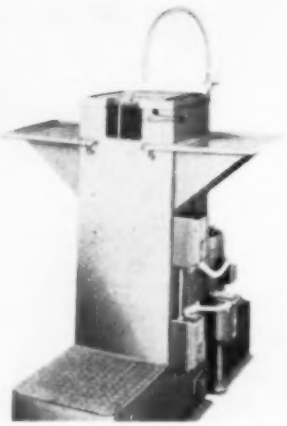
Vibrating-Rotating Machine Speeds Barrel Finishing

Vibraslide 5 is a modification of the company's Vibraslide 20 machine; new, smaller model has 5-cu-ft capacity and increased vibratory action because same power is applied to ¼ the work load.

Machines combine mechanical vibration with normal rotation. They can handle many parts previously not adaptable to barrel finishing, also permit finishing of IDs and recessed areas. Motion of the abrasive and parts allows inspection of the progress of the work without completely stopping or unloading the machine. With cylinder at rest, and only the vibrators in operation, chip load speed is between 6 and 12 rpm. Model 5 operates at 3 hp; speed of the vibrator is 2300 cycles per min. Over-all dimensions are 67 x 42 x 50 in. high.

B W Elliott Mfg Co, Binghamton, NY

MORE DATA? Circle 69, inside back cover



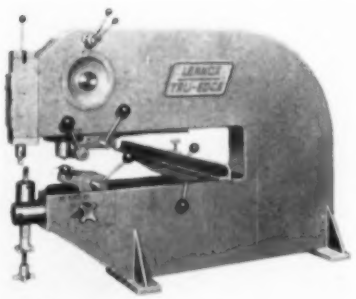
Lowcost Broaching Machine Has 2-Ton Pull, 15-in. Stroke

VM215-3 hydraulic broaching machine with 2-ton pull and 15 in. cutting stroke is priced at $1565. Cutting speed is 15 fpm; return speed is 38 fpm; worktable measures 16 x 16 in. It can be used for surface and internal broaching and will hold tolerances to ±0.0005 in.

The ram is guided by dual hard chrome-plated guide rods with lubricated bearings in the pull head. Equipment includes 2-hp motor, coolant motor, and all switches. Controls for fully variable cutting speed up to 25 fpm and 3-hp motor are available at extra cost.

Pioneer Broach Co, 6434 Telegraph Rd, Los Angeles 22, Calif

MORE DATA? Circle 70, inside back cover



Bench Model Shear-Former Has Only 5 Moving Parts

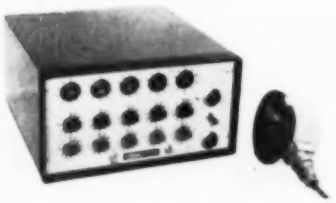
Model TE-100 Metlmastr shearing and forming machine, with only five moving parts, has a 32½-in. throat-depth and an edge-cutting capacity of 12 gage in mild steel and 16 gage in stainless.

It is equipped with a ½-hp, 110-v single phase motor and has a stroke length that can be adjusted from 0.022 through 0.110 in. without stopping the motor. The operator only has to set the stroke pointer at the gage indicated on scale. Stroke pointer setting also automatically regulates the number of strokes per minute, from 1750 to 3500, depending on the thickness of the material. Cutting speed is 8 to 15 fpm.

With the tooling available, the machine cuts in center of plate without starting hole, cuts inside, slots, joggles, beads, louvers, dishes, straight flanges, circle flanges, and edge bends.

Lennox Tool and Machine Builders, Dept 137, Lima, Ohio

MORE DATA? Circle 71, inside back cover



Dynapar Controller Automates Cutting-to-Length Operations

All-transistorized digital length controller is designed for wide range of heavy-duty automatic cutting-to-length applications.

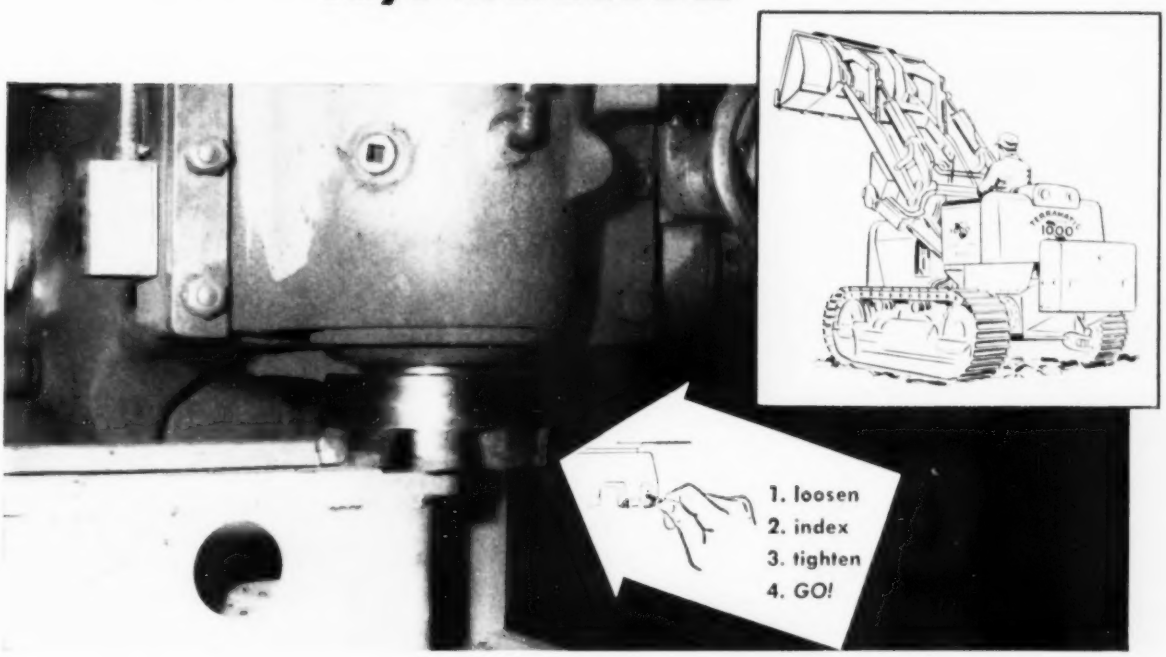
The controllers are connected to all types of shearing mechanisms which can be initiated by relay closure. Sensing devices consist of the company's high resolution Rotopulsers which are connected to measuring wheels mechanically convert material length into a proportionate shaft rotation in steps as small as 0.005 in. Simultaneously, the Rotopulsers convert this rotation into corresponding pulse signals, up to 2400 counts per rotation. These pulses are fed to the digital length controller for numerical display of linear travel and actuation of the cutoff mechanism when material reaches exact length to be cut off (previously set up on instrument panel.) Controller instantly resets for next operation. If material breakage occurs controller can stop operation and actuate a warning alarm.

Unit is available with a flip-switch length changeover control; automatic time delay compensator; automatic sequencing control system; programmed control.

Dynapar Corp, 5150 Church St, Skokie, Ill

MORE DATA? Circle 72, inside back cover

Milling Cutters are dependable says J.I.CASE



16 months of continuous milling on TERRAMATIC transmission housings

It's no "pink tea party" when you chew a quarter-inch of rough 1015 Weldment Steel casting — spinning the milling cutter at 800 s.f.p.m. That milling cutter's got to be tough — *plenty tough* — and the carbide inserts need real "backbone."

J. I. Case found the right combination in V-R Face Mill Cutters with V-R throw-away carbide inserts. Big demand for Case Terratrac dozers, diggers, and crawlers, with Terramatic Transmission, has kept production lines humming — 2 and 3 shifts a day — 16 months continuous production. In this picture there's no place for excessive downtime, or delays for tool regrinding. V-R Face Mill Cutters provide cutting edges right on the job — a turn of a wrench — index the insert to a new cutting edge — tighten — and away you go! (Minimum maintenance problems, too: in *16 months production only 3 sets of main screws and 1 chip breaker plate needed replacing.*)

Your V-R representative has the facts on Face Mill Cutters and all carbide cutting tools — call him in today or send for Catalog VR-58.

Vascoloy-Ramet corporation

PRIME MANUFACTURERS OF REFRACTORY METALS ENGINEERED FOR THE JOB

842 Market Street • Waukegan, Illinois

FM-734

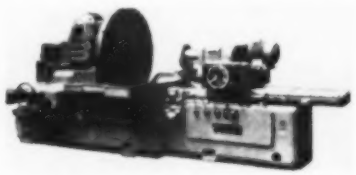
Collet Chuck Stubs Drills, Increases Tool Life

Stub-A-Long drill collet chuck for use on single or multiple-spindle drilling machines eliminates guide bushings and torsional windup in drills by stubbing. Greater stiffness permits accurate drilling without costly fixtures. Simple tooling speeds in-the-machine tool changes.

Threaded nut on the end of the chuck seats and unseats the collet. A few turns permit removal of drill which is adjustable for depth without removing collet. Chucks fit any spindle that takes an adjustable adapter from $\frac{7}{8}$ to $1\frac{7}{8}$-in. shank size. Models available use single purpose collets for drills from $\frac{1}{8}$ to $1\frac{1}{4}$ in.

Scully-Jones & Co, 1901 S Rockwell St, Chicago 8, Ill

MORE DATA? Circle 73, inside back cover



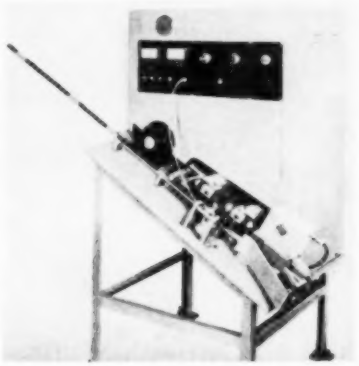
German Internal Grinder Processes Four Surfaces in One Setting

Wotan (West German) internal grinders include a hydraulic semi-automatic line, cam operated, with automatic cycling, for medium and large quantity production, and heavy-duty hydraulic grinding chuckers with up to 60-in.-dia swing, called the plain line. Versatility of the grinders makes it possible to grind all four surfaces — internal, face, external, and face nearest the chuck—in one setting, assuring perfect concentricity. Units will grind bores true within 0.00002 according to manufacturer.

The 60-in. swing grinder, Type RI 315, is illustrated. Company also builds grinders for special applications with gap beds for swings up to 5 ft, as well as machines with lengthened bed for particularly long components.

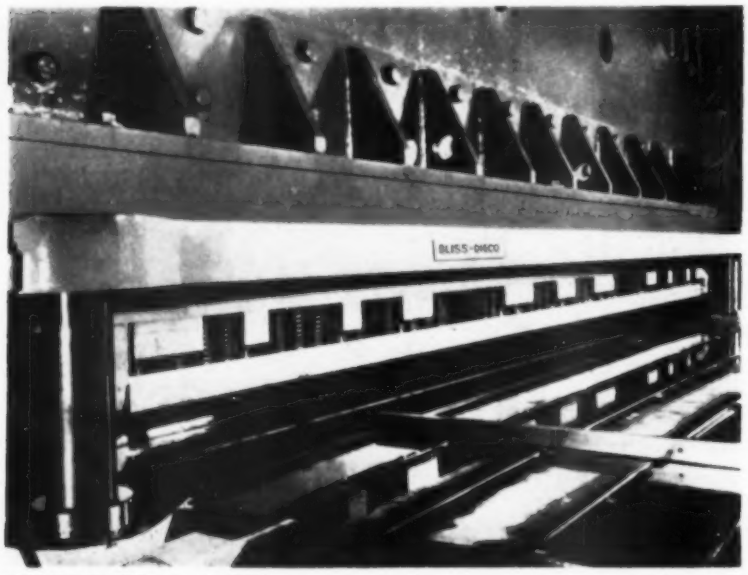
Distributed by Index Industrial Corp, 150 Broadway, New York 38, NY

MORE DATA? Circle 74, inside back cover



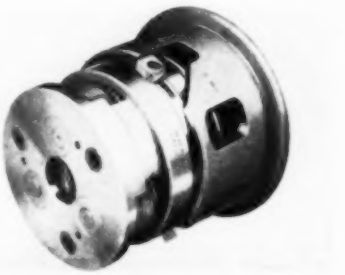
UP TO 2200 VALVE GUIDES PER HOUR are checked for cloverleaf and out-of-round on this RCA inspection machine. Machine checks to tolerances of 0.0005 in. and automatically sorts parts into acceptable or reject categories—*Radio Corporation of America, Industrial and Automation Div, 12605 Arnold Ave, Detroit 39, Mich*

MORE DATA? Circle 76, inside back cover



GIANT DIE SET, one of the largest ever made, converts a press brake for piercing and forming operations. Measuring 138 in. long, 28 in. wide, and 10½ in. thick, the die set is used by Food Machinery and Chemical Corp, Riverside, Calif, to pierce and form channels from flat stock for conveyor side rails—*E W Bliss Co, Press Div, Canton, Ohio*

MORE DATA? Circle 75, inside back cover



New Thread-Rolling Head Has Replaceable Helix Angle Bushings

Revolving thread-rolling head has been developed for exclusive application to Landis automatic forming and threading machines and 4-spindle semi-automatic threading machines. Designated the No. 7TRP (thread rolling pull-off), it has a 7/16 to $\frac{7}{8}$-in. UNF and UNC range. It can be applied to both sizes ($\frac{3}{4}$ in. and 1 in.) of machines already in service with no modifications.

A major feature of the head is replaceable helix angle bushings. One set of bushings functions as a mean helix angle for the entire UNF and UNC pitches and diameters within the range of the machine. When the exact helix angle is required for precision threads, the proper bushings can be supplied, thus eliminating necessity of purchasing a special head.

Landis Machine Co, Church & Fifth Sts, Waynesboro, Penna

MORE DATA? Circle 77, inside back cover

How the Lindner Jig Borer's Optical Measuring System reduces tooling costs

at F. J. Stokes

Lindner Model LB15A has 44" x 24" table with exclusive AUTOPOSITIONER® for pre-selecting initial and repeat table settings.

Production Jig Boring and Inspection at Stokes—51 holes, .750" diameter, 9" to 15" deep, in head of rotary tablet machine held to +.0005", —.0000" on Lindner Model LB15A. Holes are perpendicular to the base and parallel to each other within .0005".

"*Greater accuracy in jig boring* proved to be the key to more economical tooling," says Bill Kale, Chief Production Engineer at F. J. Stokes Corp., Philadelphia. "When we installed a Lindner, costs were substantially reduced."

How does the Lindner achieve this greater accuracy? Through a unique optical measuring system. Here's how it works:

There are no lead screws. No gage blocks. No bars or limit switches. The helically scribed, cylindrical measuring scales are touched by a light beam *only*. These scales are independent of the table movement mechanism and immovable in axial direction. Thus, the whole system is permanently protected against any mechanical wear whatever. Lifetime accuracy. And lifetime *economy!*

Says Mr. Kale: "Before installation of the Lindner, it was impossible to achieve such consistent accuracy. Manufacture of tooling and laying out complex jobs has now been greatly simplified. And the Lindner optical measuring system makes it possible for us to inspect the work *right in the machine*."

The Lindner optical measuring system is changing ideas about jig boring all over the country. We've packed all the facts into an informative 25-minute movie film. Send for it today without obligation, or write for literature.

KO CO., INC. PRECISION MACHINERY

KURT ORBAN

COMPANY, INC.

36 Exchange Place, Jersey City 2, New Jersey

CIRCLE 263 READER SERVICE CARD

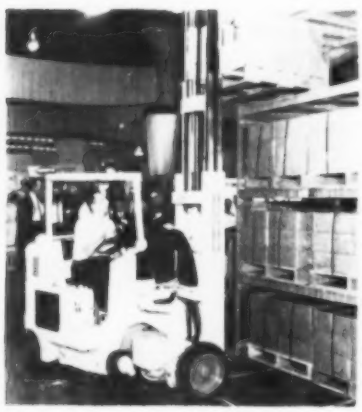
Hydraulic Lift Table Handles Dies, Feeds Sheets

Table is equipped with a die pull-off and pull-on winch that folds down and away to provide an unobstructed top with conveyor rollers for sheet-feeding operations. When the double-drum hand winch is swung up and locked into place, table is ready for use in pulling heavy dies off and onto press beds. Winch, which operates with cables and snatch blocks, can be furnished as an electrically powered unit if desired.

The 20,000-lb-capacity table pictured has a tractor hitch so that it can be moved from one location to another. Vertical movement of table top is controlled by foot switch.

West Bend Equipment Corp., West Bend, Wis

MORE DATA? Circle 78, inside back cover

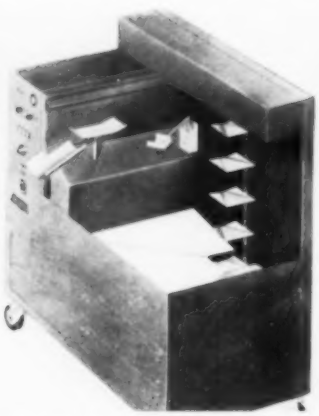


Narrow-Aisle Lift Truck Stacks Loads to Right or Left

Operating in aisles as narrow as 6 ft, this new Towmotor fork lift truck stacks loads at right angles in aisles 4 to 6 ft narrower than conventional lift trucks require. Manufacturer states that decreased aisle requirements make possible up to 50% increase in useful warehouse capacity. Equipped with hydraulic outriggers, truck performs 90-degree left or right stacking.

Towmotor Corp., 1226 East 152 St., Cleveland 10, Ohio

MORE DATA? Circle 79, inside back cover



Electronic Counter Will Handle Up to 20 Pieces Per Second

Electronic parts counter counts odd sized parts quickly and economically. Machine will count in batches for packaging, or in a running total for parts inventory. Parts of any shape or material may be counted, including parts which might interlock. Changeover time for counting a different item is less than one minute. Machine will count parts from $\frac{1}{8}$ in. to 4 in. size, weighing from 1/20 ounce to 1 lb each. For smaller parts, counting speeds to 20 pieces per second are possible.

Atronic Products Inc., Industrial Products Division, One Bala Ave., Bala-Cynwyd, Pa

MORE DATA? Circle 80, inside back cover

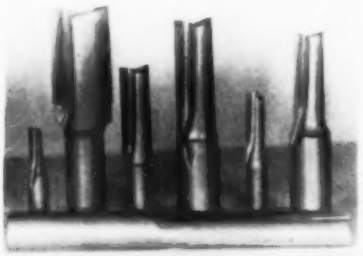
Waltz Offers Electric Furnace In Streamlined Design

Model AR gas-tight, controlled-atmosphere unit has rounded corners and few projections. Doors are air-operated by foot valve. Elements which are looped and slid into grooves in the refractory lining are 80-20 chrome-nickel ribbon of extra large cross-section. They operate on 110 v from 220 or 440-v step-down transformers located in the base of the furnace.

Free-standing control panels, completely wired, are available in various combinations. Model illustrated has a Brown strip chart recording controller, a Brown Protecto-Vane with Chromel-Alumel thermocouples. Time switch and calendar-clock mechanism turn the furnace on or off at any set time.

Waltz Furnace Co., Dept. 1, 1901 Symmes St., Cincinnati 6, Ohio

MORE DATA? Circle 81, inside back cover

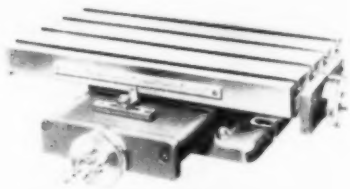


Carbide-Tipped Router Bit Has Longer Life

New carbide router bit with larger included angle and overall stronger cutting edges is said to stop vibration, allow smooth, accurate cutting, and prolong tool life. An ultra-hardened, high speed steel shank provides stiffness and fatigue resistance to prevent breakage. Tool will withstand vibrations while rotating up to 20,000 rpm. Crescent Cutter Co, the manufacturer, guarantees satisfaction as well as replacement of tool if it breaks.

Crescent Cutter Co., 232 Belleville Pike, Kearny, NJ

MORE DATA? Circle 82, inside back cover



Meehanite Cross-Slide Table Offered for Vertical Mills

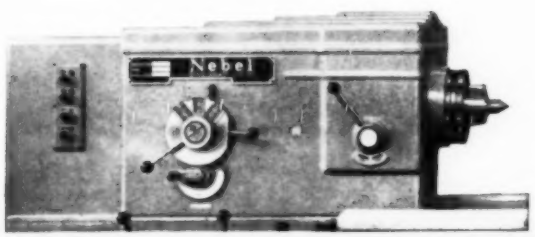
Lightweight, lowcost cross-slide table uses Meehanite for all its castings. Top and bottom are precision ground and all ways and gibs are hand scraped. Table top is 8 x 12 in. and has 4 tee slots with 6 in. scales on each slide. Dials are graduated

CIRCLE 264 READER SERVICE CARD ►

NEBEL HEAVY DUTY LATHES

entirely new . . . proven design . . .

Now, NEBEL offers you *heavy duty* precision machining in a completely new, proven design line of lathes . . . yet maintaining the substantial economies for which Nebel is famous. Choose from a complete selection of ruggedly designed, fully field-tested extension bed gap and engine lathes, with more and higher spindle speeds than ever before available from Nebel. All are manufactured to the complete A.S.A. standards and tolerances for engine lathes. Write for new bulletin.



NEBEL LATHE DIVISION
NEBEL MACHINE TOOL CORP.
3407 Central Parkway, Cincinnati 25 Ohio

from 0.001 to 0.050 per rev. The unit is 15 in. long by 4 in. high and fits all rotary tables 12 in. or more for radius and angle milling on all vertical milling machines. It is especially applicable for work on mold cavities, plungers, dies, and templets.

Lawrence H Cook, Inc, E Providence, R I

MORE DATA? Circle 83, inside back cover

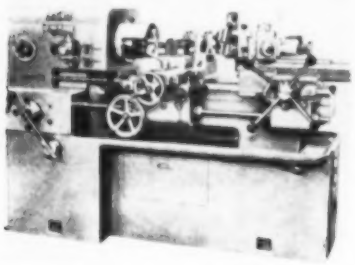
Adjustable Locator Light Spotlights Work on Machines

Locolite is designed for mounting on drillpresses, terminal setters, punches, riveting machines, and similar equipment. Device pinpoints the work area with a beam of light. It is particularly useful in riveting and terminal setting where the desired spot is often hidden by the work itself.

The 3½-in.-long unit is furnished with transformer, prism, bulb, and mounting bracket.

Black & Webster, Inc, 570 Pleasant St, Watertown 72, Mass

MORE DATA? Circle 84, inside back cover



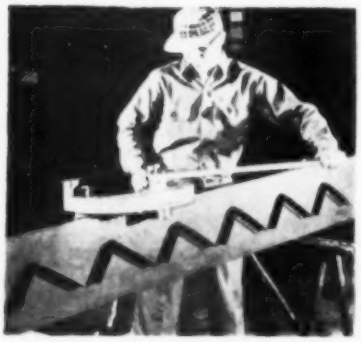
German Turret Lathe Handles Light Metals at High Speeds

Heinemann RS 40 turret lathe (German) is a medium capacity production lathe particularly suited for machining light metals at high speeds. It provides up to 1⅝-in. bar capacity and 14½-in. swing. Spindle speeds are infinitely variable on two overlapping ranges: from 65 to 470 rpm and 400 to 2700 rpm. The spindle can be stopped immediately, reversed or slowed down in a 1:5.5 ratio for quick changing on turning jobs involving threading, varying diameters, polishing or other operations requiring constant speed changes. According to the manufacturer, the lathe is priced at about 50% of comparable machines.

The lathe has a six-station, self indexing turret with eight longitudinal feeds, and a square turret on the cross-slide with eight reversible turning and facing feeds. All feeds are power operated and are selected on a star handle. Multiple stops can be set for automatic release.

Dist by Production Equipment Co, 307 S Chester Pike, Glenolden, Penna

MORE DATA? Circle 85, inside back cover



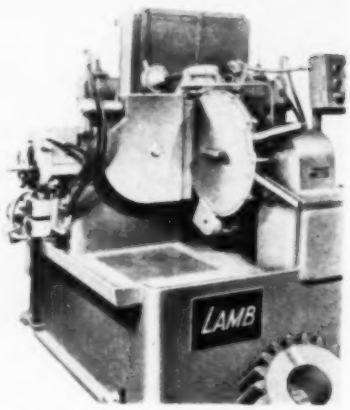
Straightener Handles Variety of Parts and Sections

Straight-O-Flex is designed to meet the need for straightening and curving parts in the manufacturer's own shop. Tool weighs 22 lbs and can be used in any position.

Work bears on two adjustable support blocks; pressure is applied by lever acting through an eccentric shaft that carries a roller-bearing-mounted pressure roll. Because of the high lever ratio, a pressure of 5 tons can be applied with very little effort. When bolted to a bench it can be useful as a push press for forming special parts and operating small dies. The adjustable support blocks and the two positions for their pins provide for 63 different working heights, or distances, between the surfaces of the support blocks and the pressure roll, giving a max of 2⅝ in. and a min of ⅛ in. Frame width is 19 in.; height, 11 in.; lever is 26 in. long.

Architectural Iron, Inc, 901 22nd St, Rockford, Ill

MORE DATA? Circle 86, inside back cover



OIL GROOVES are ground into both thrust faces of hardened transmission gears by this Lamb machine at rates of 800 to 1350 parts per hour, depending on gear size. Machine has automatic wheel dressing and compensation for wheel wear—*F Jos Lamb Co, 5663 E Nine Mile Rd, Detroit 34, Mich*

MORE DATA? Circle 87, inside back cover

Mist Collectors Offered for Electrolytic, Wet Machining

Line of Mist-Air-Rester mist collectors are offered for electrolytic and wet machining, such as tool grinders, centerless grinders, wet grinders, and others where mist or fog is detrimental. Design provides for in-corner mounting without loss of efficiency. Designs for ceiling or wall mounting are also available.

Mist and fog collected in the work area are disposed of in the filter chamber. Accessory items such as hood and piping are available for special connections to machines.

Standard Electrical Tool Co, 2480 W Sixth St, Cincinati 4, Ohio

MORE DATA? Circle 88, inside back cover

(Section continued on page 180)

Quality... the best economy of all

Another product of Sunoco research . . . a fire-resistant hydraulic fluid

The flame test, above, dramatizes the effectiveness of Sun's new fire-resistant hydraulic fluid. The wick in the conventional fluid burns readily; the wick in Sun's new fluid just can't be lighted.

SUNSAFE, a water-in-oil emulsion, eliminates fire hazards . . . provides increased safety to personnel and equipment. At the same time, operators get the essential performance characteristics of a top-grade hydraulic oil—low rates of wear, long service life, and protection against rust and corrosion.

This combination of *quality* in engineering know-how, and *quality* in product, proves once again that *quality* in any sense is the best economy of all.

For 73 years Sunoco has meant quality right down the line. Today, this quality is found in more than 400 Sunoco industrial products. SUN OIL COMPANY, Phila. 3, Pa., Dept. I-14.
In Canada: Sun Oil Company Limited, Toronto and Montreal.

MAKERS OF FAMOUS CUSTOM-BLENDED BLUE SUNOCO GASOLINES

SUNOCO

FIELD PROVEN...

Honeywell Electro Hydraulic Tracer Systems

Now operating on a wide variety of well-known machine tools (some of them illustrated at the right), Honeywell 180° and 360° Tracer Control systems provide fast, accurate and reliable system response for smooth application of large increments of hydraulic power.

They combine the flexibility, remote control and finesse of electronics with the power and fast actuation of hydraulics. They're far more flexible than completely hydraulic systems. These systems have been designed for ease of application. Modular construction simplifies and speeds field service.

Accuracy—Accuracies of ± .0005" from template to part and ± .0002 from part to part have been achieved in actual use.

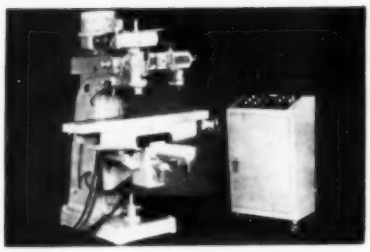
Adaptability—These systems are now in operation on all types of machine tools, from light duty engine lathes to huge spin forging machines. Every application is custom fitted—at production line prices.

Performance—Each Honeywell system becomes an integral part of the machine tool. The control system can be adjusted to compensate for changes in machine performance during the life of the machine. Speed range of 500 to 1 is normal; greater rangeability is available on some applications. Tracing speed ranges up to 60" per minute are available.

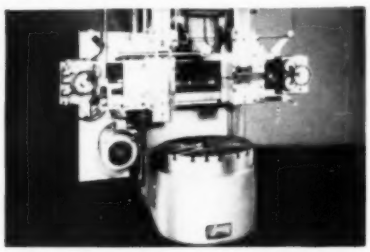
For further information on Honeywell's new machine control systems and components and their application to your specific job, contact Minneapolis-Honeywell, Machine Control Group, Dept. AM-9-93, Minneapolis 8, Minnesota.

Honeywell

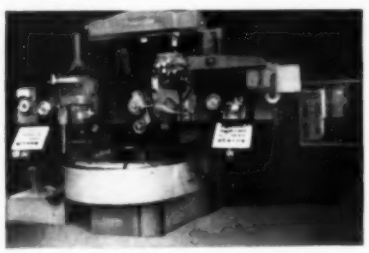
H First in Control



Gorton Vertical Milling Machine equipped with Honeywell 360° Electro Hydraulic Tracer Control System.

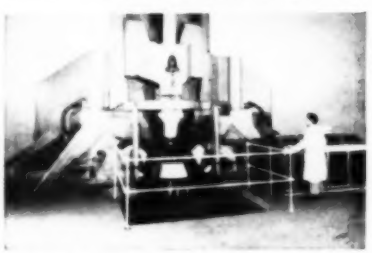


Giddings & Lewis vertical turret lathe with Honeywell 360° Electro Hydraulic Tracer Control System.

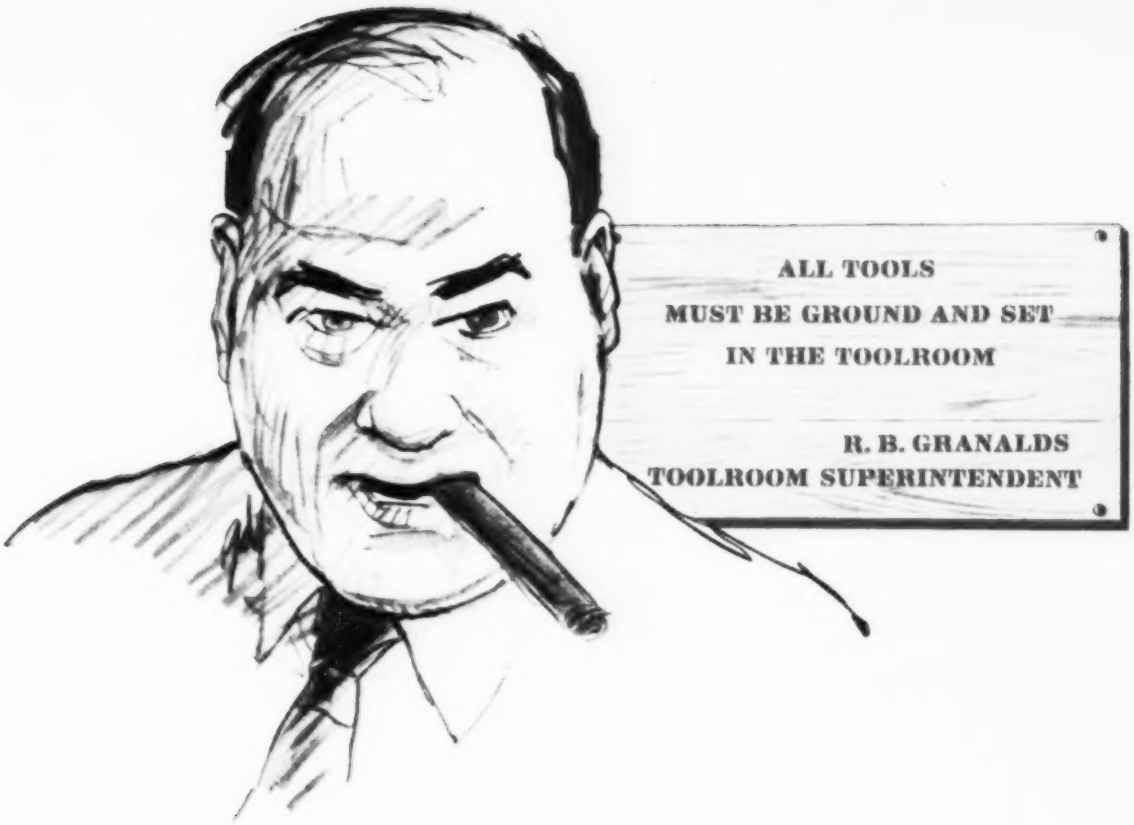


Frauenthal Division of Kaydon Engineering Corporation turning and grinding machine with Honeywell 180° Electro Hydraulic Tracer Control System.

Rockford Machine Tool Company hydraulic mill with Honeywell 180° Electro Hydraulic Tracer Control System. Swarfing operation.



Hufford Corporation spin forge machine with two Honeywell 360° Tracer Control Systems plus spindle speed control.



"We're responsible for all the tools in the plant"

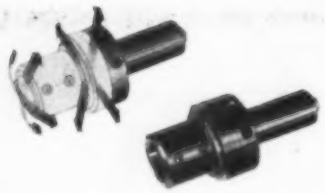
"Since we took over the sharpening and setting of all tools about two years ago, average tool life in the shop has increased by a third. It all started with an article in one of the magazines we get. I sold the idea to the boss and it really panned out."

Many a cost-cutting idea in Metalworking has started in the same fashion: with an article or advertisement in a magazine. With stress today on higher output at lower cost, Metalworking production management is alert to ways that will achieve these twin aims. Men like our hypothetical but typical Granalds must work out ways to do the job – and spend less.

American Machinist is a veritable gold-mine of ideas for Metalworking engineers and executives. It presents them with basic production data coupled with the newest developments and in-plant know-how throughout a $120 billion industry. That's why, in plant after plant, Metalworking production men will tell you . . .

"I have to read American Machinist"

McGraw-Hill Magazine of Metalworking Production
330 West 42nd Street, New York 36, New York



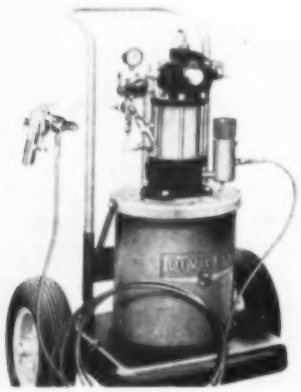
Turret Lathe Toolholder Corrects For Angular, Radial Misalignment

New Tru-Align corrects for both radial and angular misalignment between the center line of spindle and the center line of the turret holder, so that the tool feeds into the work in perfect alignment with the spindle every time. Holder locks the tool in position once true center alignment between turret and spindle is established; no further adjustment is required.

OD of the shank and bore of the holder are precision ground to assure proper positioning in the turret. It is available in a variety of sizes to fit all of the most popular makes of turret lathes.

Sonnet Tool & Mfg Co, 576 N Prairie Ave, Hawthorne, Calif

MORE DATA? Circle 89, inside back cover

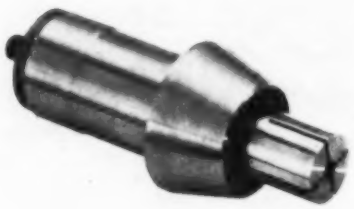


Airless Paint Sprayer Reduces Application Problems

Spray painting equipment that atomizes paints directly without using compressed air has been introduced by the DeVilbiss Co. Vapor and overspray are said to be substantially reduced, making the new equipment suitable for use in closed-in areas. The wider spray pattern of the airless gun makes faster coverage possible. On rough work, masking and shielding can be largely eliminated because of the sharp, clean edges of the spray pattern, according to the manufacturer. The airless principle is simple. Paint is forced through a small nozzle under 1800 to 2400 psi. As the paint leaves the nozzle under high pressure it expands quickly, becoming atomized in the process. The tiny paint particles have sufficient velocity to carry over to the painted surface, but strike the surface with too little force to rebound. The unit is cart-mounted, and completely self contained.

The DeVilbiss Co, Toledo, Ohio

MORE DATA? Circle 90, inside back cover

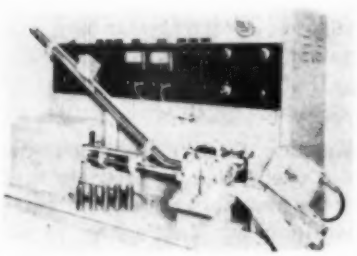


Dunham Offers Expanding Collet for Turret Lathes

New push-type line of expanding collets has been introduced for turret lathes. Collets will handle internal chucking from ¾-in. to 6 in. Master collets (4140 heat treated steel) are available in types 1 thru 5 W&S. Soft expanding mandrels are available from the manufacturer in 1, 1½, 2, and 2½-in. dia, and in lengths of 1½ or 2 in. They are easily machined to required size on customer's turret lathe, thus assuring accurate concentricity.

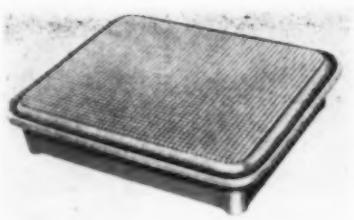
The Dunham Tool Co Inc, R4, Danbury, Conn

MORE DATA? Circle 91, inside back cover



HARDNESS TESTER automatically measures hardness of piston pins at rates of up to 2400 per hr and sorts them into acceptables and rejects. It can be fed manually or receive parts directly from a processing machine—*Radio Corp of America, Industrial & Automation Div, 12605 Arnold Ave, Detroit 39, Mich*

MORE DATA? Circle 92, inside back cover



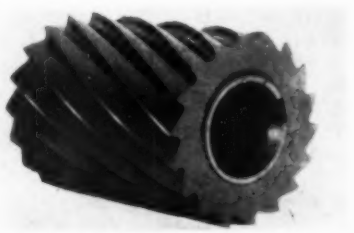
Line of Lapping Plates Offered With Flatness Held to 0.0001 in.

Fine grain lap iron lapping plates, available in four sizes, are annealed and heavily ribbed to assure retention of accuracy. Integrally cast trough around outside edge catches excess compound and prevents loss of diamond dust.

Smallest size, 6 x 9 in., is serrated to form ¼-in. squares on lapping surface. Larger sizes, 9 x 12, 12 x 15, and 15 x 18 in., are serrated into ⅜-in. squares. Prices are $42.40, $53.20, $68.60, and $96.80 respectively.

American Lap Co, 20184 Sherwood, Detroit 34, Mich

MORE DATA? Circle 93, inside back cover



Fine Fluted Milling Cutter Designed for Tough Alloy Steels

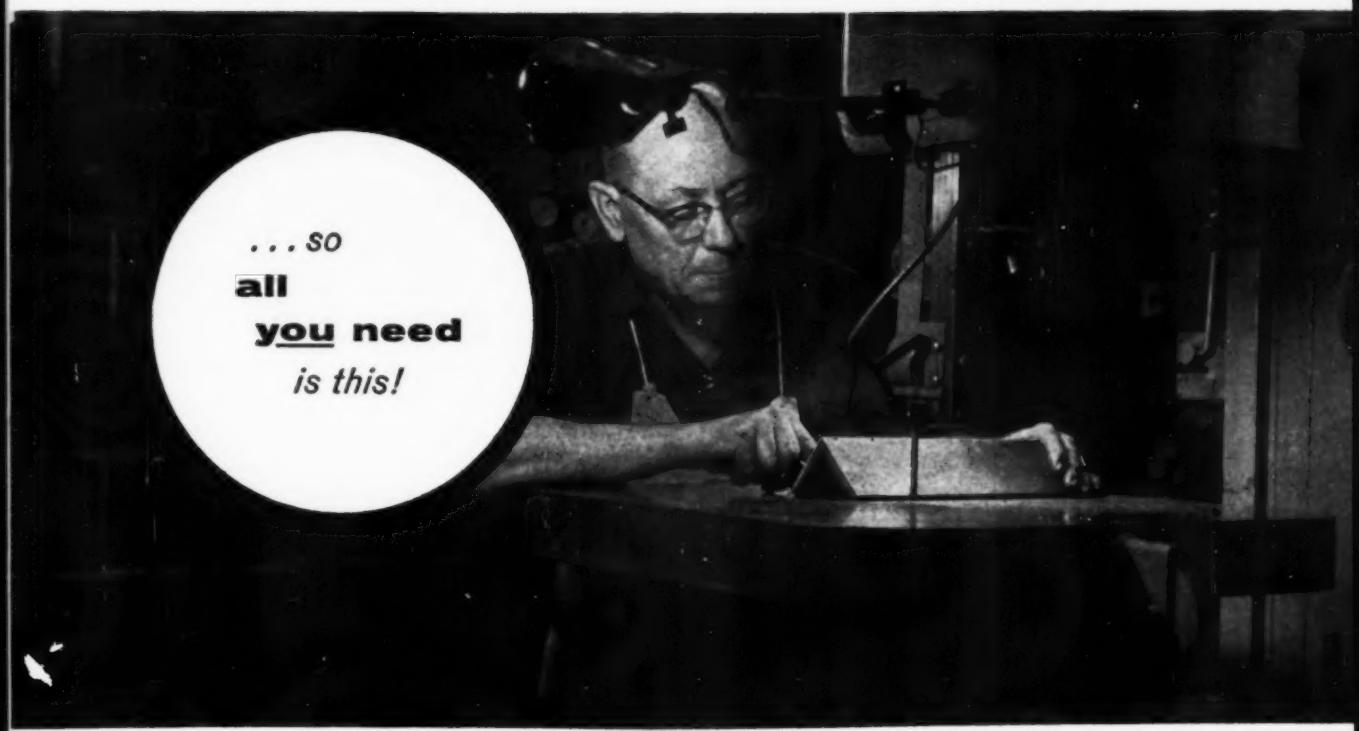
Tool, ground from solid carbide, is said to produce a finish comparable to that of grinding because of higher cutting speed and wider feed range.

Cutters have been used for milling square punches at the Ford tool plant for several years. Design has reportedly doubled and, in some cases, tripled production over HSS cutters; tool life has been increased up to 50 times according to company engineers. In addition, the solid carbide eliminates the vibration found in insert blade construction. Material milled in the Ford operation has usually been S5 or S2 steel, with most of the cutting done in climb milling applications. Cuts have been up to ¼ in. deep and ½ in. to 1 in. wide at a feed of 2 to 4 ipm.

M A Ford Mfg Co, 1545 Rockingham Rd, Davenport, Iowa

MORE DATA? Circle 94, inside back cover

Photos courtesy of Viking Steel Company



Want to save additional investment in expensive steel cutting or processing equipment? Then use the efficient facilities for cutting, shearing and slitting maintained by your Youngstown Distributor. You'll conserve capital, save manpower and floor space. Hold down your own steel inventories, too, by making full use of your distributor's complete local stocks and fast delivery service. You'll find him a mighty efficient partner-in-production.

AMERICAN STEEL WAREHOUSE ASS'N

THE
YOUNGSTOWN
SHEET AND TUBE COMPANY
Youngstown, Ohio

Manufacturers of Carbon, Alloy and Yoloy Steel

CIRCLE 274 READER SERVICE CARD

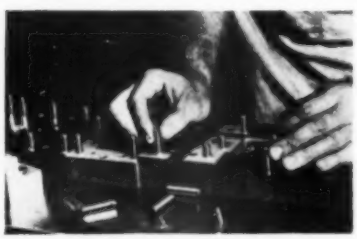
ALLEN

ALLEN is the dowel pin that gives you PLUSES!

Your ALLEN Industrial Distributor can show you a good many ways to use ALLEN Dowel Pins, in addition to conventional uses in tool and die work. You can use them as economical roller bearings, axles, precision plugs, hinge and wrist pins—and in many other ways.

You can cut the cost of your product substantially, too—because your ALLEN Distributor can supply these strong, accurate, mirror-finished Dowel Pins in standard sizes right from stock.

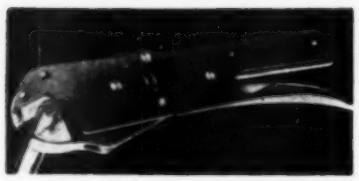
Made of special Allenoy steel; surface hardened to 62-64 Rockwell C; precision ground to .0001" with micro-inch finish of 6 RMS max. Check your Allen Handbook or Catalog for detailed specs and standard sizes, or write direct for samples and technical information.



Genuine ALLEN products are available only through your ALLEN Distributor—he's always ready, willing and able to give you prompt, practical service.

ALLEN MANUFACTURING COMPANY
Hartford 1, Connecticut

ALLEN HEAD



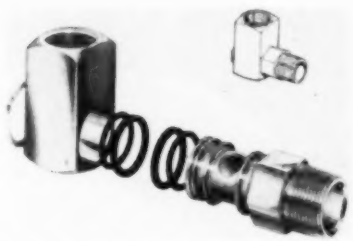
Pressure Lock Wrench Is Multi-Purpose Tool

BMC wrench can be used as an adjustable pipe or end wrench, straight - duty or ratchet - action pliers, portable hand vise, or cable-and-guy-wire clamp.

Operator turns adjustment nut to desired jaw opening; calibrated scale and indicator show gripping space. With jaws over the work, lever is snapped shut. Wrench remains locked until the lever is pushed away. Tool is made of high-carbon steel with heat-treated jaws and crack-resistant Tenite handle.

Fem Tool & Die Co, 1317 S Halsted St, Chicago 27, Ill

MORE DATA? Circle 95, inside back cover



90° Swivel Connector Delivers Hydraulic Fluid at Any Angle

Unit, offered for industrial use, is capable of delivering hydraulic fluid at any angle under adequate pressure, thereby eliminating one of the most common causes of hose failure due to extreme flexing. Since the connector absorbs part of the swing, less hose allowance is needed for complete extension of the moving part. Features include low torque operation and freedom from friction, even at high pressures up to 5000 psi. Fluid pressure is absorbed equally by a double seal at each end of the stem.

Various combinations of stems can be interchanged with any body style. Ends which are presently available include male pipe, hydraulic male, O-ring male, plus solid and swivel female, in sizes ranging from $\frac{1}{2}$ through $1\frac{1}{2}$ in.

Eastman Mfg Co, Manitowoc, Wis

MORE DATA? Circle 96, inside back cover

NEW SHOP EQUIPMENT

2-wheel hoist trolley with 500 lbs capacity for straight and curved monorail systems is designed for 4-in. I-beam rails. Loading capacity can be doubled to 1000 lbs by using two trolleys with load bar between. Ball-bearing wheels and hardened guide rollers permit max loads to be pushed easily by hand.

Anchor Steel & Conveyor Co, 6906 Kingsley Ave, Dearborn, Mich

MORE DATA? Circle 97, inside back cover

Sinter-Seal is a new process developed to eliminate problem of porosity in powder metal parts. It is a specially compounded thermo-setting plastic resin which is impregnated into the pores of the sintered metal part. Treated parts are then cured under controlled temperatures until the plastic is an inert, permanently hard mass which renders them completely pressure-tight and non-absorbent through positive clear-through sealing action.

National Sinter-Seal Co, 669 Seneca Industrial Center, Buffalo 10, NY

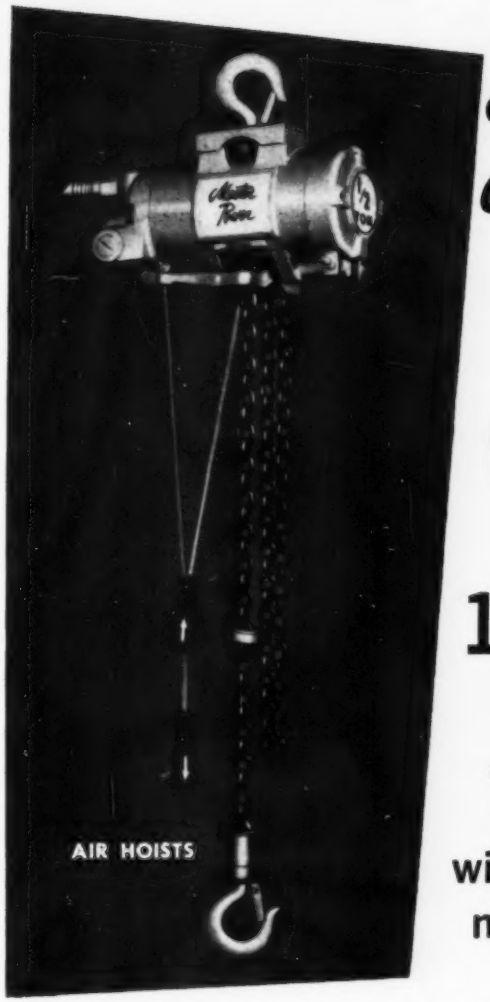
MORE DATA? Circle 98, inside back cover

Multi-purpose lubricant, Keystone No. 88, can be used in 90% of all ball and roller-bearing installations, is also said to produce excellent results in plain bearings, needle bearings, and on rotating and sliding surfaces. This high film-strength lithium base product has operating temp range of from 0 to 275 F and melting point close to 400 F.

Keystone Lubricating Co, 3100 N 21st St, Philadelphia 32, Penna

MORE DATA? Circle 99, inside back cover

"Would you please hang your tie somewhere else."



TEST CUSTOMIZED *Master Power* AIR HOIST ON 10-DAY FREE TRIAL with absolutely no obligation

Designed for 128 basic variations. A 10-day tool test will prove you cannot burn out or damage this hoist with an overload. Positive control from creep to full speed with safe lowering if air or brake fail. Explosion-proof model available. Mail coupon today to arrange a 10-day tool test.

Master Power CORPORATION • Bedford, Ohio
A Black & Decker subsidiary

Look under TOOLS-PNEUMATIC HOISTS-PNEUMATIC

Master Power Corporation, Dept. 209, Bedford, Ohio

Gentlemen: I want to run a Master Power 10-Day Tool Test. I understand there is no obligation.

☐ I am interested in *Impact Wrenches*
☐ I am interested in *Threaded Fastening Tools*
☐ I am interested in *Percussion Tools*
☐ I am interested in *Abrasive Tools*
☐ I am interested in *Air Hoists*

Company.....

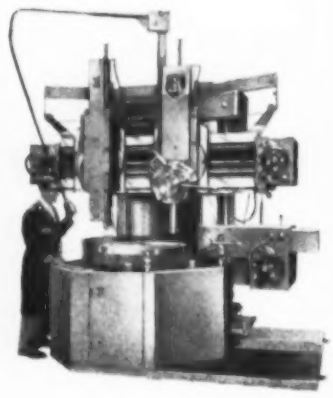
Individual.....

Street..... City..... Zone.... State.....

In Canada: MASTER PNEUMATIC TOOLS (CANADA) LTD., REXDALE-TORONTO, ONTARIO

GIDDINGS & LEWIS

No time wasted jockeying for position with Giddings & Lewis directional tool controls



G&L: fastest vertical turret lathe there is

Any operator who has had "stick time" on this new kind of VTL will tell you it is easy to operate. Any time-study man who has set rates for the machine knows it is faster.

One of the reasons is improved controllability. Directional joy sticks for controlling feed and rapid traverse are located at each head. The tool goes the way the operator points the stick so he never has to take his eyes off what he's doing.

Rail controls are located under each head, making it easy to raise or lower the rail from either side of the machine. Only table speed, start, stop, and jog controls are on the pendant.

Cutting speeds are faster, too. G&L 32", 42", and 52" verticals have greater rigidity behind the rail and under the table. Our full-depth, double-walled, box-type column provides greater capacity in a more compact design. That's why the standard table drive permits cutting speeds up to 3000 sfpm.

Faster cutting speeds and increased controllability change the economics of turret lathe work. They make it possible to reduce total cost per piece—machine time, overhead, and direct labor—using today's improved carbide cutting tools. Call your G&L distributor, or write for Catalog VTL-3.

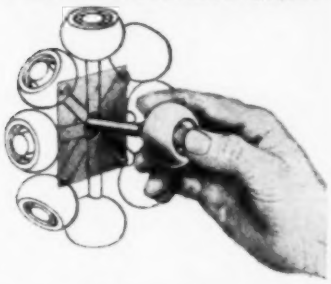
GIDDINGS & LEWIS MACHINE TOOL COMPANY

Fond du Lac, Wisconsin

Giddings & Lewis manufactures: vertical and horizontal boring machines, vertical turret lathes, planers, planer mills, contour milling machines, die sinking machines, drilling machines, numerical and tracer control systems, boring tools and related items, and machine tool accessories.

CIRCLE 277 READER SERVICE CARD

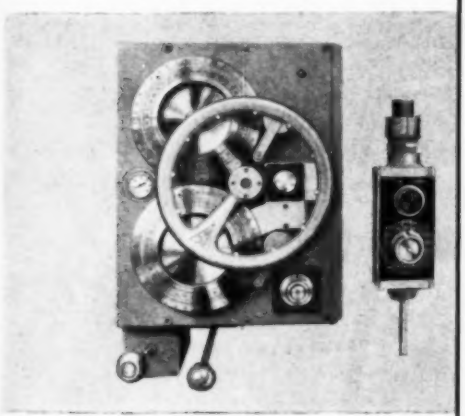
Why the G & L VTL cuts faster, into costs



Saves time between cuts—Fewer motions and less effort are required for setup and operation. Moving the directional joy stick up or down feeds the ram up or down. Moving it left or right engages saddle feed left or right. Moving it at a 45° angle synchronizes saddle and ram feeds for 45° tool travel.

Increases speed and feed in the cut—The operator never has to stop this machine to change speeds or feeds. He simply dials the pendant control for any one of 32 speed changes in two overlapping ranges. Feeds are dialed at each head, with a 16-step dual-range dial keyed to the speed range engaged. Incentive to use the right speed or feed on every cut increases accuracy, improves finish, and prolongs tool life.

Changes speeds without stopping cut—The constant-mesh, planetary-table drive is designed to change speeds on the fly. Compact design permits mounting the entire drive in a very small space in the bed. This leaves all of the column behind the rail and side heads for structural cross-ribbing—one reason why you get more productivity out of a machine that requires 30% less floor space.

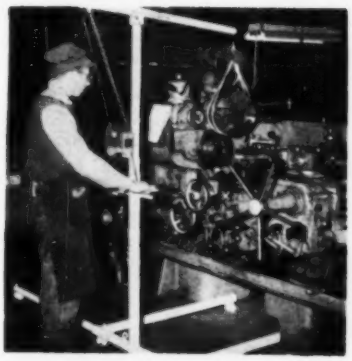


Symbol for machining cost reduction

GIDDINGS & LEWIS

VTL-100

CIRCLE 278 READER SERVICE CARD



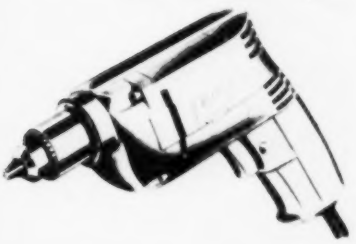
Hand-Winch-Powered Crane Positions 300-lb Loads

Model WC54A Junior Crane, designed for transporting and safe positioning of loads up to 300 lbs, is powered by a small hand winch with mechanical ratio of 30:1. For capacity load, operator needs only 10 lbs of force to operate the lever handle for gentle, slow movement and careful positioning in special jobs where rough handling could cause severe damage. Entire heavy dismantling or assembly job can be completed without assistance from heavy overhead production cranes and other equipment.

Telescoping masts give a total lifting height of 9 ft. 6 in. Sidebars on mast permit smooth transport and turning of the entire crane.

Thern Machine Co, 3760 W Fourth St, Winona, Minn

MORE DATA? Circle 100, inside back cover



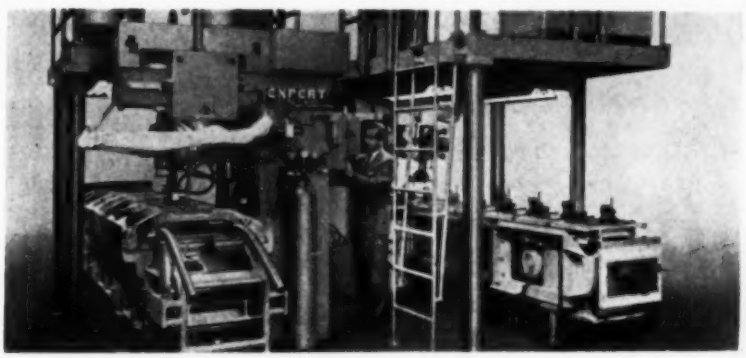
Portable Drills Feature More Power, Less Weight

New line of Thor portable electric SpeedDrills features increased power, lighter weight, and a choice of spade-grip or pistol grip handle in each model.

Line's heavy-duty models are designated Nos. 1251, 1266, and 1276 and are equipped with ball and needle bearings, heat-treated alloy steel gears, and heavy-duty geared chucks. Other features include die-cast aluminum housings, 10-ft 3-conductor lead cord with adaptor, 3.1 amp rating, and momentary contact switch with locking pin for continuous duty.

No. 1251 has a ¼ in. capacity in steel, with 1400 rpm full load speed, 2200 rpm no load speed. No. 1266 has a 5/16 in. capacity in steel full load speed of 1100 rpm, no load speed of 1700 rpm. No. 1276 has a ⅜ in. capacity in steel, full load speed of

(continued on page 188)

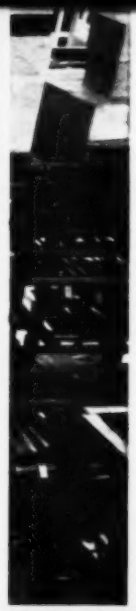


AUTOMATED WELDING MACHINE is equipped with an over-and-under transfer system that utilizes the standard Expert cam index drive which provides accurate, high-speed and shock-free indexing. Machine pictured welds both sides of a bracket to an automobile front crossmember at production rate of 647 parts per hr. Machine consists of two separate over-and-under systems; one is used to weld the top part of the bracket to the crossmember, and the other welds the bottom part of the bracket to the crossmember. Index drive for this unit provides a 36-in. index in 1½ sec with repeatability accuracy of index of 0.010 in.—*Expert Automation Machine Co, 17144 Mt Elliott Ave, Detroit 12, Mich*

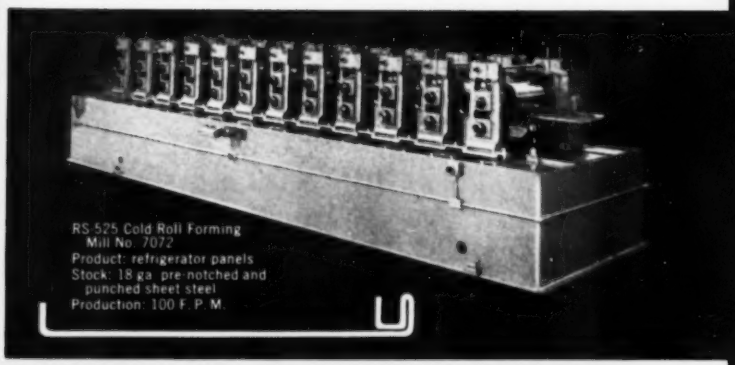
MORE DATA? Circle 101, inside back cover

Roll forming upswing.....

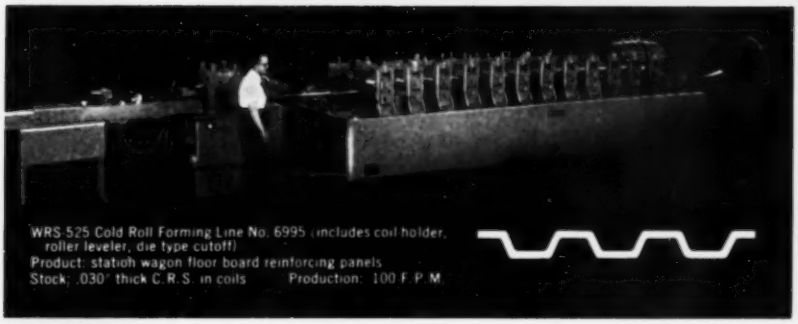
Recently installed in the plant of one of America's leading steel companies was this McKay cold roll forming line for the forming and cutting to length of industrial shelving angles up to .116" mild steel strip with pre-notched holes for joining. Line is composed of double rotating coil holder, roller leveler, pre-notching press, forming machine, cut-off, run-out and kick-off table.



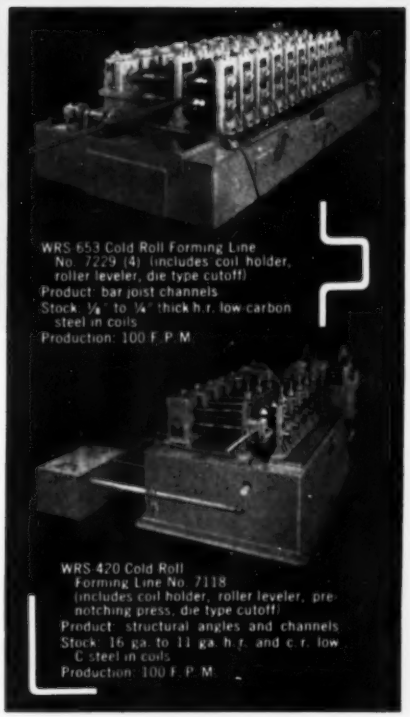
Completely Automatic Rim Rolling Line No. 6798
Product: automobile and farm implement drop center wheel rims
Stock: welded steel bands
Production: 600-900 Rims per hour



RS-525 Cold Roll Forming Mill No. 7072
Product: refrigerator panels
Stock: 18 ga. pre-notched and punched sheet steel
Production: 100 F. P. M.



WRS-525 Cold Roll Forming Line No. 6995 (includes coil holder, roller leveler, die type cutoff)
Product: station wagon floor board reinforcing panels
Stock: .030" thick C.R.S. in coils Production: 100 F. P. M.



WRS-653 Cold Roll Forming Line No. 7229 (4) (includes coil holder, roller leveler, die type cutoff)
Product: bar joist channels
Stock: ⅛" to ¼" thick h.r. low-carbon steel in coils
Production: 100 F. P. M.

WRS-420 Cold Roll Forming Line No. 7118 (includes coil holder, roller leveler, pre-notching press, die type cutoff)
Product: structural angles and channels
Stock: 16 ga. to 11 ga. h.r. and c.r. low-C steel in coils
Production: 100 F. P. M.

Manufacturers of all kinds of products look to McKay Machine for roll forming equipment to lower man-hour costs!

To increase man-hour production, manufacturers are turning to the automated roll forming line. In recent years McKay Machine engineers have developed equipment that enables fabricators to produce more and more products in a continuous stream directly from coiled stock.

From drop center wheel rims and station wagon floor boards to finished refrigerator parts, manufacturers are finding roll forming gives them greater production control and product uniformity while eliminating many costly intermediate manufacturing functions.

Analyze your production—there may be a way you can take advantage of roll forming economies. To help you, why not rely on the 20 years of roll forming leadership of the *McKay Machine Company, Youngstown, Ohio.*

McKAY McK MACHINE

◄ CIRCLE 279 READER SERVICE CARD

CIRCLE 280 READER SERVICE CARD

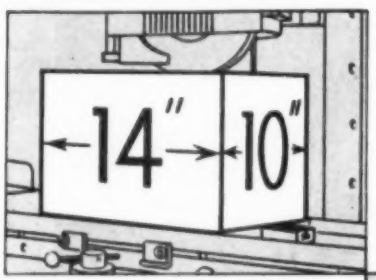
NOW! for the FIRST time HYDRAULIC FEED on a 10" x 16" grinder

LOW COST
Micro-Precision, High Speed Grinding

No. 17H
Priced at only
$3285.00
to give you the operating ease and high speed of hydraulic feed for little more than the cost of a hand feed grinder.

For precision surface grinding on tool room or production jobs, you can't beat the Covel No. 17H. The large grinding wheel with plenty of direct power *plus* high speed hydraulic feed and big cross-feed capacity make it a real money saver. *Grinds approximately twice as fast as with a comparable hand feed machine.*

FULL 10 INCH CROSS-FEED CAPACITY



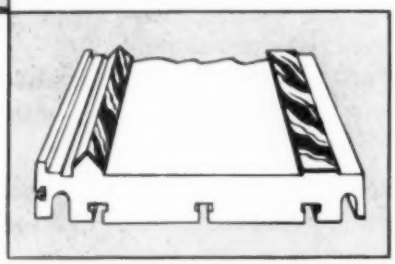
The full 10" cross-feed capacity of the Covel No. 17-H puts it in a class by itself among surface grinders in its price range. You get the extra working capacity you need for bigger jobs without paying a big premium in price!

HARDENED AND GROUND LEAD SCREWS have precision ground threads for smooth, accurate transverse and vertical feed.

PRECISION QUILL TYPE SPINDLE is grease lubricated and sealed for life. 2 HP, 1750 RPM direct drive motor.

FIRST WITH HARD CHROME TABLE WAYS

Available at extra cost for super long-lived accuracy. Hard chrome is applied direct to V and Flat table ways after hand scraping to master plate, preserving original built-in accuracy.



Micro-Precision a Covel Tradition-Since 1874

COVEL PRECISION GRINDERS
BENTON HARBOR, MICHIGAN

Write, wire or call us TODAY We'll gladly show you what the Covel 17H can do for you. Ask for Bulletin AM-189

650 rpm, no load speed of 1000 rpm.

Drills weigh from 4¼ to 4¾ lbs and cost from $46 to $48, depending on models.

Speedway Div, Thor Power Tool Co, 1421 Barnsdale Rd, LaGrange Park, Ill

MORE DATA? Circle 102, inside back cover

Metal-plating process named Pyro-Plate, performed by heat treating, transforms a thin layer of plating substance into an integrated part of the base metal. First step in the process is to apply paint-like or paste facing materials, compounds composed of nickel or cobalt alloys; next step is controlled heat treating in special atmospheres. Typical of the varied applications are machine cutting tools such as drills, taps and milling cutters; rotary and blade knives.

Metallurgical Consultants, Inc, 4935 E Slauson Ave, Maywood, Calif

MORE DATA? Circle 103, inside back cover

Plastic retainers for needle thrust bearings are available for use in the automotive, aviation, hydraulic, and other industries. Non-standard-size units can permit substantial savings over those of steel since they require lower tooling costs for new sizes.

Torrington Co, Torrington, Conn

MORE DATA? Circle 104, inside back cover

High-temp furnace, Lucifer 6055E, is of box-type construction and includes elements with heat ranges to 3190 F. Series includes seven models in box or tube design. All are complete units and include an automatic controller

"We all have to do things we don't like, Charlie. For instance, I don't like coffee."

(indicating and controlling), platinum-rhodium thermocouple, magnetic contactor, high-temp elements, terminals, aluminum strips for terminal connections, selector switch, and an element transformer.

Lucifer Furnaces, Inc, Neshaminy, Penna

MORE DATA? Circle 105 inside back cover

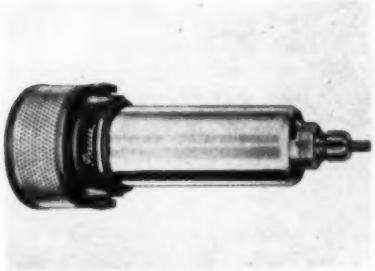
Line of Miniature Grinding Tools Available in Diamond and Carbide

New line of Starlite diamond and Starbide carbide tools originally developed to facilitate the grinding of miniature parts for the jet aircraft and missile industries can be used wherever precision miniature tooling is required.

Carbide tools include a 1/32-in. end mill, a 0.022-in. spade drill, a 0.030-in. twist drill, a 1/16-in. reamer, and a 0.066-in.-thick slitting saw. All have diamond-lapped super-finished cutting edges to minimize chip buildup. Also illustrated is a Starlite diamond 0.025-in.-dia jig and internal grinding tool with Magnicon metal bond. Larger sizes are available.

Starlite Industries, Inc, 58th & Market Sts, Philadelphia 39, Penna

MORE DATA? Circle 106, inside back cover



Power Quill Designed For Small Parts Production

High speed power quill, Model Super 70, was designed to perform high precision mass production of small parts. Power quill has ⅜-in.-collet capacity, and offers load speeds from 15,000 to 35,000 rpm. Motor and drive are combined in

There's a BIG difference in floor absorbents

MAKE THIS DISCOVERY!

RIGHT IN YOUR OWN OFFICE you can test the difference of Eagle-Picher Industrial Floor-Dry with whatever oil absorbent you're now using. You'll discover it actually absorbs as much as 100% or more liquid per pound than other floor drying materials.

YOU'LL ALSO PROVE that Eagle-Picher Floor-Dry retains its skid-proof granular mineral form even when saturated. It doesn't mud or pack. Light in weight, it spreads easier and covers a larger area. Non-combustible, it has no chemical reaction. And possessing unusual reflective power, Floor-Dry makes working conditions bright and pleasant, as well as safe!

Since 1843 EAGLE EP PICHER

WRITE TODAY. Our Eagle-Picher representative will bring the portable laboratory to your office where you may make this test yourself. **The Eagle-Picher Company, Dept. AM 921, Cincinnati 1, Ohio.**

VALVOLINE
Tectyl
protects metals
against RUST

VALVOLINE'S amazing Tectyl rust preventives protect metal surfaces against *every kind of rust and corrosion* during storage and shipping.

Low-cost Tectyl compounds are easy to apply by brush, spray or dip and just as easy to remove. They protect metal surfaces against . . . sun and rain . . . heat and cold . . . salt air and salt water . . . humidity, perspiration and corrosive fumes.

Tectyl rust preventives meet exacting government specifications.

Write today for these two helpful Tectyl charts

1. "Valvoline Tectyl U. S. Government Approved Packaging and Preservative Chart." Gives the Army, Navy and Air Force "Specs" and applications.

2. "Valvoline Tectyl Industrial Rust Preventive Comparison Chart." Specifies applications covering the entire field.

VALVOLINE
Tectyl
ALL-METAL PROTECTION
RUST PREVENTIVES

VALVOLINE OIL COMPANY, Freedom, Pennsylvania
Division of Ashland Oil & Refining Co.

single machine tool. Tool will mount easily on any machine tool, and will perform close tolerance machining to 0.0001 in., according to the manufacturer. Equipment includes built-in filtration unit, variable speed control, and meter calibrated in rpm for precise control by operator.

Precise Products Corp, Racine, Wisc

MORE DATA? Circle 107, inside back cover

Form-relief boring cutters, HSS and carbide-tipped, are designed to make the chip curl and break up easily, flushing out along the shank of the tool. Especially adapted for internal work, they provide a constant clearance angle throughout the life of the tool. Line is available in complete range of sizes.

Maxwell Industries, Inc, 493 E 5th Ave, Ashtabula, Ohio

MORE DATA? Circle 108, inside back cover

Sine plates in new small size are available in magnetic (Magna-Sine) and non-magnetic models. Units have a 4 x 4-in. working area. Magna-Sine table has a permanent magnet chuck that firmly holds small work without distortion. Non-magnetic sine plate table has a ground surface and tapped holes for clamping of work. Both models permit rapid angular setup of small to medium size work for grinding or inspection operations. In addition to single angle setups, compound angles can also be set up by combining either two Magna-Sines, a Magna-Sine with a sine plate, or two sine plates.

Omer E Robbins Co, 11961 Dixie Ave, Detroit 39, Mich

MORE DATA? Circle 109, inside back cover

"You never attended one of his Monday morning briefings before?"

NOW THE WORLD'S GREATEST VALUE IN A COPYING LATHE.

THE CLEARING-HARRISON

Just $3750.00*

†Base Price F.O.B. Chicago, Los Angeles, New York.

* 11" Copying model—$3,750.00†
Standard 11" model—$1,950.00

Here are copying lathes at prices you would normally expect to pay for a standard machine! Yet the Clearing-Harrison is a world beater of a lathe—carefully designed and as rugged as they come.

Check These Features!

Standard Duty—Copying mechanism doesn't interfere with the use of the lathe for standard operations.

Induction Hardened Bed Ways—Ways are hardened and ground by Delapena equipment—virtually exclusive with the Clearing-Harrison

Precision hardened gears

Anti-Friction Bearings to the Spindle

FIND OUT MORE ABOUT THE COPYING LATHE YOU CAN OWN FOR WHAT YOU'D EXPECT TO PAY FOR A STANDARD MACHINE. WRITE CLEARING TODAY!

Clearing, division of U. S. Industries, Inc. also manufactures the Clearing-Axelson line of engine lathes, power presses of all types, dies and special tooling and special equipment for the aircraft and missiles industry.

Write for Clearing-Harrison catalog

13" Copying model—$4,850.00†
13" Standard model— $2,950.00†

16" Copying model—$6,950.00†
16" Standard model—$4,450.00†

Coast to Coast Service Facilities

Clearing's nationwide facilities assure you of prompt service always. Replacement parts and accessories are stocked at Clearing and are available through all three plants, at all service centers and through all Clearing dealers.

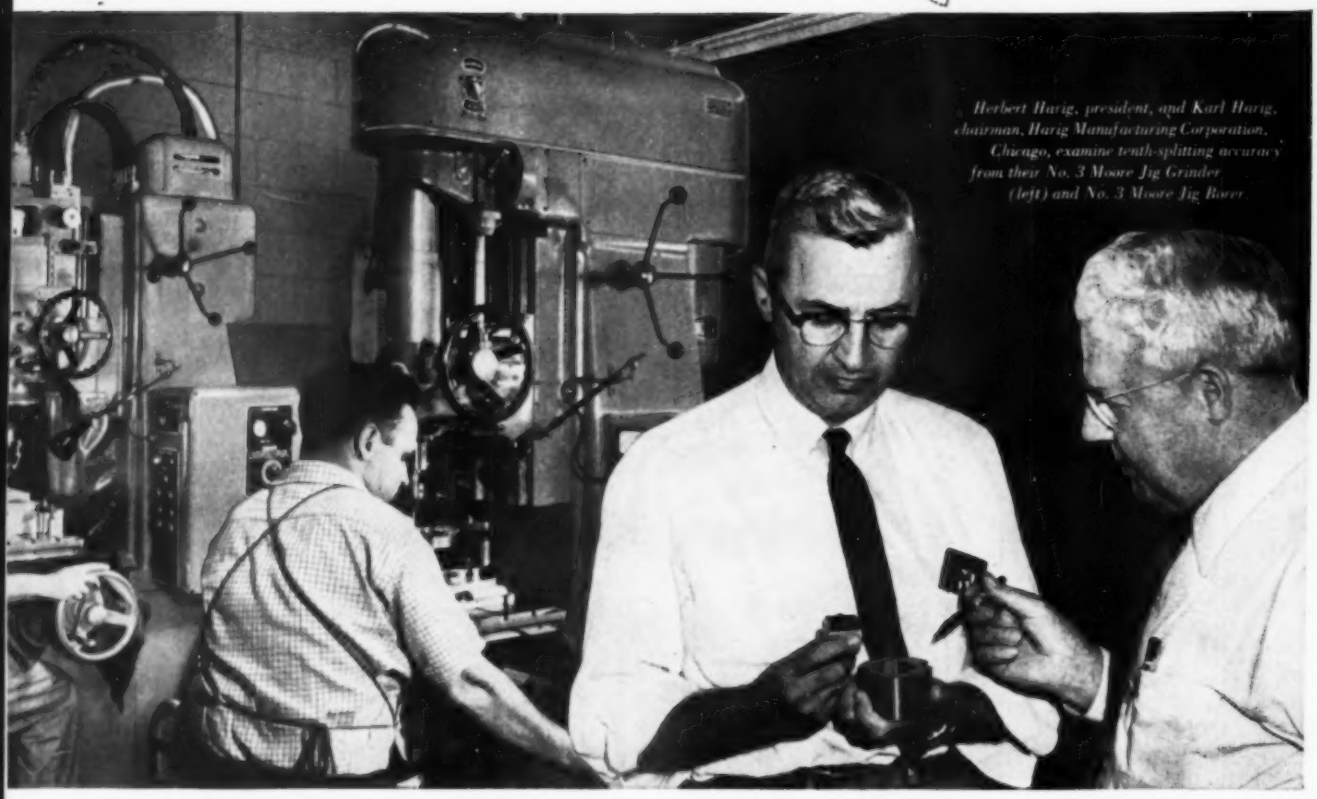
USI Clearing

DIVISION OF U. S. INDUSTRIES, INC.

6499 W. 65th Street • Chicago 38, Illinois

Plants in: Chicago, Ill. • Hamilton, Ohio • Los Angeles, Calif.

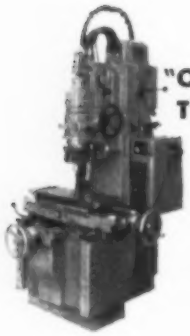
MOORE ACCURACY FOR THE MISSILE AGE



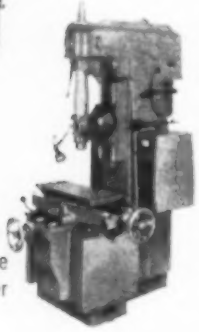
Herbert Harig, president, and Karl Harig, chairman, Harig Manufacturing Corporation, Chicago, examine tenth-splitting accuracy from their No. 3 Moore Jig Grinder (left) and No. 3 Moore Jig Borer.

"We're now splitting tenths, thanks to Moore's new No. 3 Jig Borer and Jig Grinder"

"Our operators feel these are the best machines they have ever worked on... They take care of the tenth-splitting tolerances required by industry today."



No. 3 Moore Jig Grinder



No. 3 Moore Jig Borer

Made and calibrated to the New International Inch.

These are the words of two of America's acknowledged tooling leaders, active heads of one of America's foremost independent producers of accurate dies—carbide, lamination, progressive, and other precision tooling.

Says Herb Harig, president of Harig Manufacturing Corporation and former president of National Tool & Die Manufacturers Association: "Moore's line of Jig Borers and Jig Grinders has been an integral part of the development of our company from 15 employees in 1937 to 120 today. We have always been among the first to install each new model. That's why we are among the first with Moore's tenth-splitting No. 3 Jig Borer and No. 3 Jig Grinder. Over the years we have enlarged our Moore Jig Boring and Jig Grinding Department to 15 machines!"

Sums up Chairman Karl Harig: "When owner-management invests its money in machinery, it does so only after thorough analysis and careful selection. I don't know of any machine manufacturer which meets both these tests better than does Moore."

We stand ready to help you duplicate Harig's record of satisfaction. As a start, write today for our detailed literature on these new tenth-splitting machines with larger tables; hardened, ground and lapped ways; no gibs, no overhang.

MOORE SPECIAL TOOL COMPANY, INC.
738 Union Avenue, Bridgeport 7, Conn.

ADD MOORE TOOLS TO YOUR TOOLROOM

JIG BORERS • JIG GRINDERS • PANTOGRAPH WHEEL DRESSERS • PRECISION ROTARY TABLES • HOLE LOCATION ACCESSORIES

CIRCLE 285 READER SERVICE CARD

FIELD REPORT...

Timken Building Second RR Bearing Production Line

Timken Roller Bearing Co will build a new railroad bearing production facility at its Columbus (Ohio) railroad plant at a cost of $5.3 million. New unit, with annual producing capacity capable of equipping 20,000 freight cars with all-purpose AP railroad bearings a year, will duplicate capacity of the present production line, bringing total capacity of the plant to 40,000 car sets a year. Equipment for the new facility will be ordered immediately and present estimates indicate that the line will be in operation by the fall of 1960. About 150 additional employees will be needed to man the new line.

Westinghouse Electric to Build Thermoelectric Device for Navy

Company has a contract to build the largest and most versatile device yet undertaken for heating and cooling by thermoelectricity. Order calls for delivery to the Navy's Bureau of Ships, of an experimental triple-purpose unit that combines into a single system a thermoelectric air conditioner, space heater, and refrigerator-freezer. System will produce heat and cold with solid state materials and without moving parts. Navy will use it to test the suitability of thermoelectricity for air conditioning and refrigeration on ships.

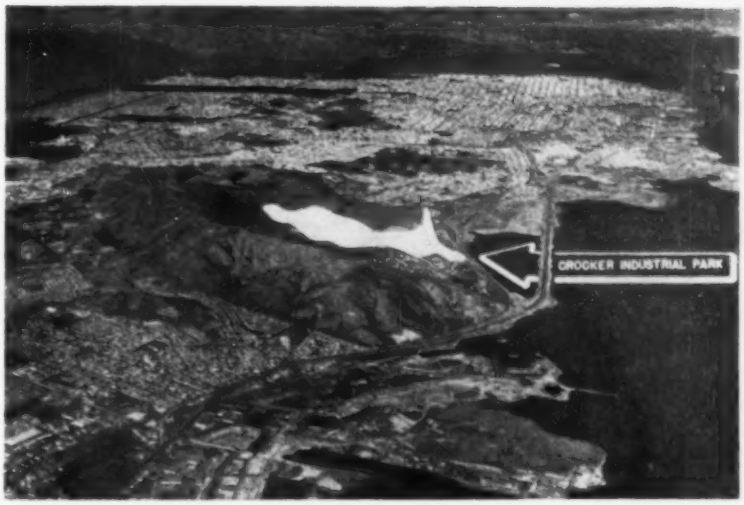
Road Block at Autonetics

North American Aviation is threatening to remove its multi-million-dollar Autonetics plant from Compton, Calif, unless the city or Los Angeles county provides its employees with additional access to the plant. At present one narrow thoroughfare serves as the only way to and from the facility. A 200,000 sq-ft addition is planned for the plant but unless government officials cooperate, the whole works may be moved to Orange county, resulting in a loss of 3000 jobs in the Compton area.

New York Ship Humming

Keel for the second of two 10,210-deadweight-ton dry cargo vessels being built by New York Shipbuilding Corp for the American Export Lines has been laid at the Camden, NJ, yards on the Delaware River. It is being constructed on the same ways from which New York Ship recently launched the NS Savannah, the world's first nuclear-powered passenger-cargo vessel. Designed for the New York-Mediterranean service, the two cargo vessels are part of American Export's long-range replacement program and are being built by NYS under a $22.8 million contract. Keel for the first was laid in June; delivery of both is scheduled for the latter half of 1960.

Other major shipbuilding projects currently under way at NYS include the Kitty Hawk, first aircraft carrier to be armed with guided missiles; two nuclear-powered subs; two 45,500-deadweight-ton tankers and one 35,000 tonner; six guided missile destroyers; two guided missile frigates; a conventionally powered sub; and conversion of the cruiser Little Rock to a guided missile vessel.



New industrial park for San Francisco . . .
Site of the new Crocker Industrial Park just outside San Francisco city limits. The 250-acre area is designed for light manufacturing, warehouses and distributing services for the region's metalworking industries. The Park is adjacent to a six-lane highway that feeds into the Bay Area's freeway system, and to Southern Pacific's main line

Indonesians learn US die-design techniques . . .
Stanley R Cope, president, Acme School of Die Design Engineering, South Bend, Ind, shows how a die is designed for stamping out a protective helmet to Tahjan Soemantapoera (left) and Mohammed K Seedarjawiredja (right) as Graydon L Wilson of the Bureau of Apprenticeship & Training looks on. The students are attending the South Bend School under the auspices of the International Cooperative Administration, will complete a nine months' course, then return home to teach die design to their fellow Indonesians

Unisorb Pads are the basic unit in a mounting specification used to install 107 machines, including heavy Gisholt Turret Lathes and small bench grinders.

Minneapolis-Honeywell reports...

Unisorb Pads Saved Over $15.00 On Every Machine Installation!

The Minneapolis-Honeywell Regulator Co. Valve Division at Fort Washington, Pa., after careful pre-testing, found that Unisorb pads were both economical and efficient for mounting machines in their new plant. Here's why:

- Labor costs alone saved about $15.00 per machine (mounting time)
- There were savings on anchoring materials
- Reduces noise and vibration up to 85%
- Greatly reduced productive hours lost in moving
- Machines kept in alignment
- Provides ease of shop rearrangement
- Machines stay safely anchored in place

Company after company are discovering these same facts – that Unisorb Pads and Unisorb Level-Rite Mounts can save time and money, and cut noise and vibration, every time a machine is installed.

TRY A SET IN YOUR PLANT! ***UNISORB is available at leading Industrial Distributors, or write direct for the special Unisorb Money-Back Trial Offer.***

UNISORB 200 SOUTH STREET BOSTON 11, MASS.

Division of The FELTERS Company

Want more information? Send for Unisorb Bulletin!

Please send me Unisorb Information Bulletin

Name .....

Position .....

Company .....

Address .....

City ..... Zone ... State .....

FEB-33

Field Report . . .

Raytheon's Big Maine Plant

Raytheon Co will start construction early in the fall of a 140,000 sq-ft semiconductor production plant in Lewiston that will eventually employ more than 2000 persons. Facility will be operated by the electronics firm's Semiconductor Division in addition to its present laboratories and plants in Massachusetts. Transistors, diodes, and rectifiers will be produced in the new plant which is scheduled for completion by mid-1960.

$15 Million Order to Lear

Lear, Inc, Santa Monica, Calif, has a $15 million contract from the Navy for an all-altitude flight director and low-altitude bombing systems, including spare parts and necessary ground support equipment. New order raises company's backlog to a record $87 million.

British Baby Car

British Motor Corp is set to market the Mini-Minor, a small car costing less than $1000 basic price, with top speed of 70 mph and fuel consumption claimed to be better than 50 mpg when cruising at 50 mph. Production of the car, which is underway at both Austin and Morris plants, is expected to reach 4000 a week by year's end. Investment in the tooling program has already exceeded $30 million.

Road holding characteristics of the new car are generally acclaimed to be superior to any small car in the

(Continued on page 198)

"We'll promote him to manager—that'll get him out of the union—then we'll sack him."

DIEMAKERS...

Cut costs here

Free-machining DESEGATIZED® HIGH ALLOY DIE STEELS

4

grades regularly stocked for long-run die applications...

- **OLYMPIC FM** (Type D-2)
  ... for typical long-run applications
- **BR-4 FM** (Type D-7)
  ... for extreme abrasive service
- **GSN FM** (Type D-3)
  ... to meet non-deforming requirements
- **COBALT CHROME FM** (Type D-5)
  ... for extra resistance to galling and pickup

Latrobe's 12% chromium die steels are easier to work, easier to machine . . . because they contain evenly-dispersed, fine alloy sulphides which permit faster speeds and feeds, and result in better machined surfaces.

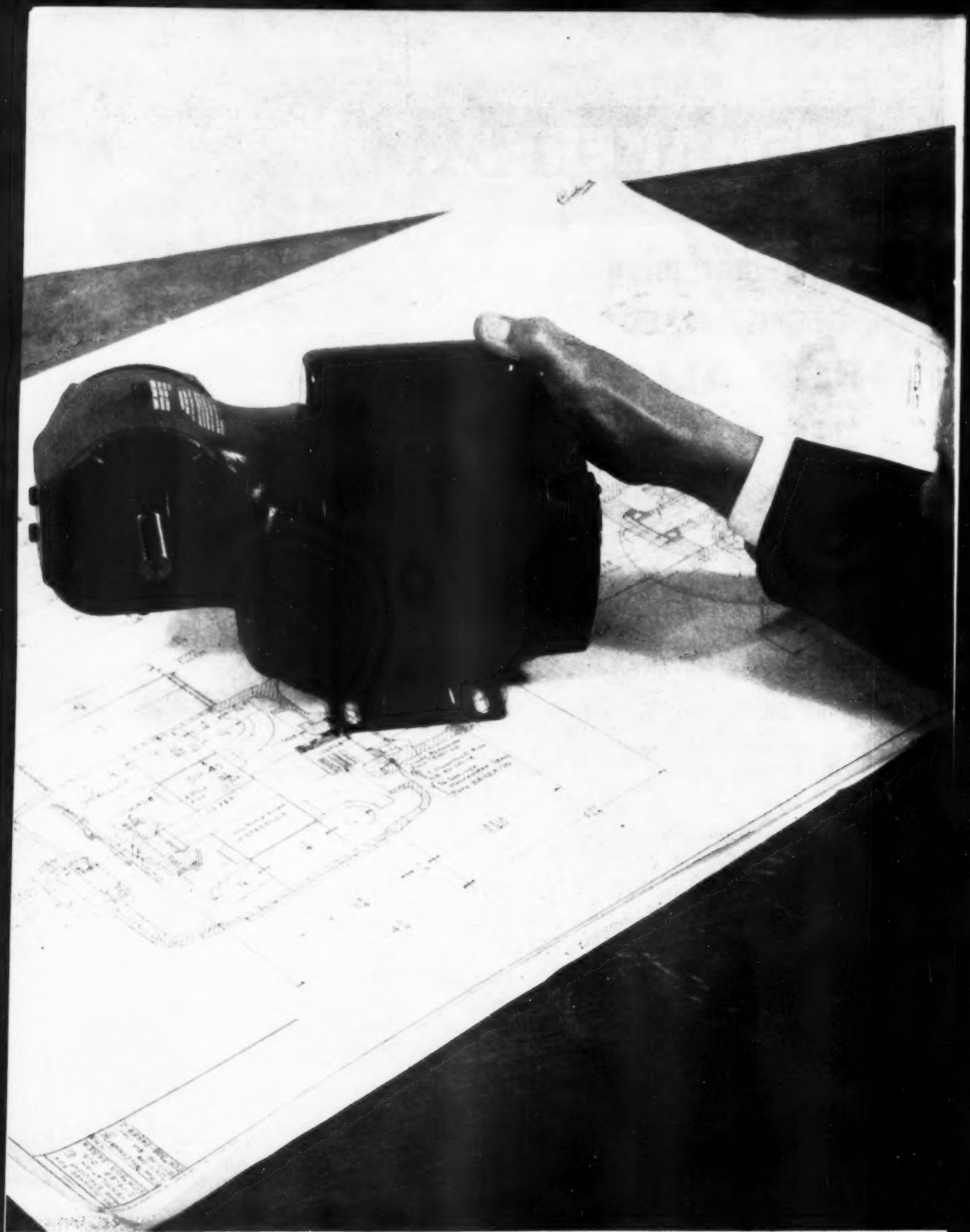
As a result of Latrobe's DESEGATIZED process of manufacture, these steels are fully-uniform . . . free of harmful carbide segregations. They're tougher, respond readily to heat treatment, and possess unusual wear resistance characteristics.

For better die steels and technical service, call your Latrobe representative today!

LATROBE Metalmasters

LATROBE STEEL COMPANY
LATROBE, PENNSYLVANIA

BRANCH OFFICES and WAREHOUSES:
BOSTON • BUFFALO • CHICAGO • CLEVELAND • DAYTON
HARTFORD • LOS ANGELES • MIAMI • MILWAUKEE • NEW YORK
PHILADELPHIA • PITTSBURGH • SAN LEANDRO • TOLEDO



New Century Electric single-reduction, right-angle gear-motor is smaller, lighter and more versatile than ever.

CIRCLE 288 READER SERVICE CARD

New Century Electric Gearmotor

combines compactness with dependable power

Looking for a small gearmotor that is light and compact—yet able to handle heavy thrusts and the shock of sudden overloads? This new Century Electric single-reduction, right-angle shaft gearmotor may be the answer. Here are the facts:

Smaller and lighter. You can cut as much as 20 pounds from the weight of any product . . . in the ⅛ hp size, for example, this gearmotor weighs only 23 lbs. New insulating materials and new designs make more compact motors . . . new gearing and oil seal systems make gear housing smaller. Result: savings of about 50 percent in overall size.

Dependable power. Both motors and gearhead are built by Century Electric . . . means this gearmotor is backed from one source. Single-phase motors include capacitor start and split phase types. Polyphase motors are squirrel cage design.

Little or no service is needed because of features like:

High quality gear system—Worm gear is made of tough silicon bronze. Worm is made of hardened, high-grade steel. Both can withstand sudden shocks and overloads.

Dependable sealing system—No oil can get from gears into motor and cause costly shutdowns. A face-type seal with spring backing is used on the high speed shaft. A lip-type seal is used on the low speed shaft.

Output-shaft roller bearings—Roller bearings on output shaft provide reserve strength so motor can handle heavy radial and thrust loads and sudden shocks of overloads. Bearings are precisely aligned so worm and worm gear operate efficiently and quietly.

All-angle oiling—No matter at what angle motor is mounted, the worm or worm gear is always dipping in oil—so gears are always well lubricated. Means less wear and longer life.

Versatile mounting. You have complete freedom in mounting. Here's why. The gearhead can be assembled in four different positions in relation to the motor (the diagram below shows three of these positions) . . . shafts can extend from either or both sides of the gearhead . . . oiling and sealing systems make it possible to install gearmotor at any angle.

You can get more information from your nearest Century Sales Office or Authorized Distributor. Variations are available to fit specific design needs. For a copy of the new Century Electric Motor Application Guide, write for bulletin 270A.

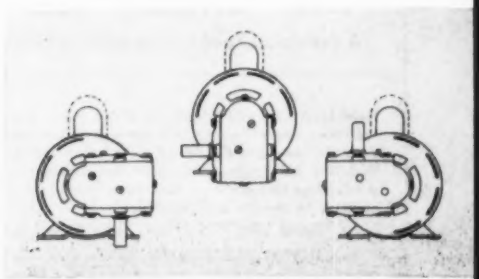
CENTURY ELECTRIC COMPANY

St. Louis 3, Missouri *Offices and Stock Points in Principal Cities*

Century

59-12

Both polyphase motors and single phase, capacitor start motors are available in the new Century Electric gearmotor.



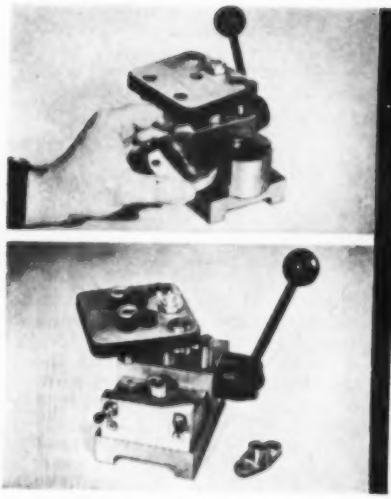
Three of the four possible mounting positions of gearhead . . . shaft can be extended from opposite side in all cases.

CIRCLE 289 READER SERVICE CARD

TOOL QUICKLY

LIFT SWING DRILLING FIXTURE

For Long or Short Runs
Saves Precious Tooling-Up Time
and Fixture Costs



Low Initial Cost

Separately tooled top plates can be used on the same fixture base.

Swing-away top plate permits faster drilling operations, and provides tremendous tooling-up advantages. Take advantage of the "ease of tooling" features.

ABC

Write for Lift Swing Tooling Suggestions. Bulletin LS-58

ACCURATE BUSHING CO.

ASA Standard Drill Bushings • Precision Parts • Lift-Swing Drilling Fixtures

440 NORTH AVE., GARWOOD, N. J.

CIRCLE 290 READER SERVICE CARD

The **LINLEY JIG BORER**

A Precision Tool — Compact — Simple To Operate

How long can you afford to tie-up large capacity borers for toolroom work? Linley Jig Borers, made specifically for the purpose, can handle all of your small precision jig boring—fast and efficiently. Investigate the possibilities in these Linley precision-producers . . . for more flexibility in your shop, for savings in money and machines.

Table Size: 7" x 17½"; Table Travel: 6½" x 10".

IT WILL PAY YOU TO INQUIRE — WRITE NOW!

LINLEY BROTHERS CO.

664 STATE ST. EXT. • BRIDGEPORT 1, CONN.

world because of its front drive, small wheels, independent lightweight suspension, and low center of gravity. BMC has virtually retained the existing four-cylinder, overhead valve, water cooled engine fitted to the Morris Minor, but has shortened the stroke which reduces the engine capacity to 850 cc and the output to 34 Bhp at 5400 rpm. Car weighs 1270 lbs. Lightweight rubber cones, which need no lubrication, replace coil springs in front and rear suspension.

RCA Gets Army Job

Radio Corp of America has a $2.3 Army Signal Corps contract to expand an electronic miniaturization program. RCA engineers are working on extremely small elements, uniform in size and shape, which can be combined into a single tiny unit to perform a complete circuit function. While efforts are mainly connected with defense work, results will probably be applied to civilian products as well. These would include tiny radios, desk-top computers, and flat, wall-tube TV sets.

Unlocking Davy Jones

Isthmus Steamship & Salvage Co, Miami, is planning a war cargo salvage program that company officials estimate could net $75 million in sunken metal cargoes. Firm is currently selling 146,912 shares of common stock to finance the project. Some 1900 Allied ships carrying tonnages valued at $3 billion were sent to the bottom by enemy subs during WW II. Isthmus has spent a quarter of a million dollars since 1949 in

"I would like to compliment you on your workmanship . . . When are you going to give me the opportunity?"

For FASTER CUT-OFF SAWING at the LOWEST COST-PER-CUT

the ALL NEW

Milband

BAND SAW MACHINE TOOL

- FAST CUTTING WITH EXTREME ACCURACY
- NARROWER KERF MEANS REDUCED CHIP LOSS
- MINIMUM BLADE STRESS, MUCH LONGER BLADE LIFE
- CUTS ARE CONSISTENTLY STRAIGHT, SMOOTH, ACCURATE

ADVANCED DESIGN

- RUGGED CONSTRUCTION WITH RIGID, OVERSIZED BLADE WHEELS
- FULLY AUTOMATIC OPERATION
- WIDE RANGE OF INFINITELY VARIABLE BLADE SPEEDS
- CONVENIENT, CENTRALIZED CONTROLS
- FAST-ACTING HYDRAULIC VISE
- RECIRCULATING COOLANT SYSTEM

The Blade Behind the Machine

. . . is the MILFORD REZISTOR High Speed Steel Band Saw Blade. Ideal team-mate for the MILBAND Machine Tool, this blade is made from red-hardness steel, outlasts ordinary carbon steel blades many times, and production-saws stainless steel and other tough alloys these blades cannot cut.

SPECIFICATIONS

Blade Speed Range	40 to 360 fpm, infinitely variable
Blade Feed	hydraulic, with compensating flow for work section variations
Motor	3 hp drip-proof with oil-tight push button controls
Blade Guides	carbide, individually adjustable
Blade Tensioning	hydraulic, with tension maintained automatically
Work Receiving Table	25½" x 26½"
Machine Dimensions:	
Width, Including Vise Guard	43½"
Length	93"
Height, Head Down	55"
Height, Head Raised	65"
Bar Feed Dimensions:	
Width, Including Vise	49½"
Length	73"
Weight of Machine and Bar Feed	3000 pounds
Blade Type and Size	MILFORD REZISTOR High Speed Steel Band Saw Blade, 1" x 15'

SAW & BAND SAW BLADES · STOCK · HACK · HOLE SAWS · GROUND FLAT

MILFORD

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Saw Specialists For Over 80 Years

The HENRY G. THOMPSON & SON CO.

MACHINE TOOL DIVISION • 271 CHAPEL ST., NEW HAVEN 5, CONNECTICUT

DIRECT REPRESENTATIVES AND DISTRIBUTORS IN PRINCIPAL CITIES

FEEDCISION

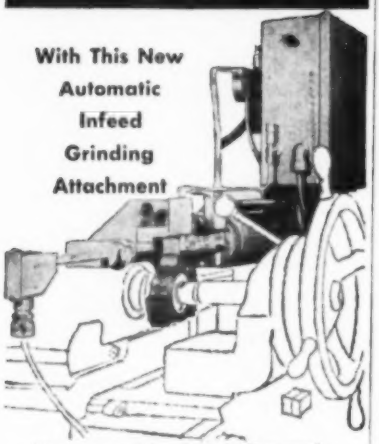
INCREASES CENTERLESS GRINDING PRODUCTION

200%

YES

300%

With This New Automatic Infeed Grinding Attachment



Utmost precision in grinding and duplicate sizing. Sizing dial is graduated in (.00001) one hundredth of a thousandth of an inch. No hydraulic checking cylinder to change feed rate when oil is cold. No checking of oil level or refilling of hydraulic checking cylinder. Three (3) different feed rates are available in one unit for the fastest, most efficient, and precise sizing in a centerless grinder.

CAN BE USED FOR TRU-FEED AS WELL AS INFEED for close sizing. Ideally located push button control station consists of Stop-Button, Caution Pilot Light, and a selector switch for set up or auto grinding positions. **CATALOG** — Write for it today!

MODERN DEVICES

Subsidiary of

TWENTIETH CENTURY MFG. CO.

Box 429 A Libertyville, Illinois

Open Territories for Manufacturers' Representatives

Field Report . . .

research, pinpointing locations and securing options.

Included in the planned salvage operations is the SS Bayard, torpedoed in 1942, and a US ship sunk in the Caribbean during the war carrying 5000 tons of uranium ore from Africa, valued at $6 million; two ships with Bethlehem steel cargoes with combined value of $1 million; and a group of 22 sunken vessels off the coast of British Guiana, all 22 lying within a one-square-mile area. Company will use a derrick-equipped barge to scoop metal from the sunken holds. Salvage will then be placed aboard Isthmus' recently purchased 5000-ton cargo-salvage ship and sent where it will bring the highest price.

Square D Expands Into Germany

Square D Co, Detroit producer of electrical equipment, has entered the central European market with the opening of a subsidiary company, Square D GmbH, in Neuss am Rhein, Germany. This is the fourth foreign office established by the firm; other plant and sales sites are in Canada, Mexico, and England.

Fairchild's New Copter-Plane

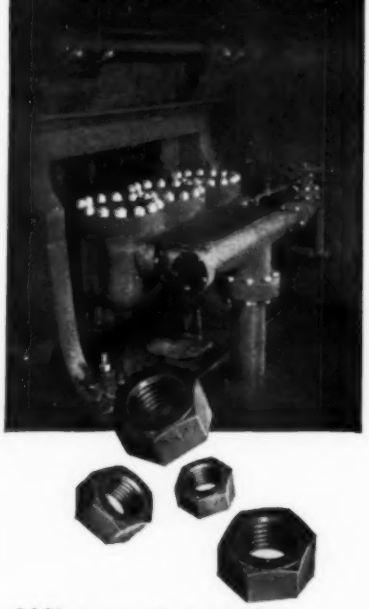
Fairchild Engine & Airplane's Hagerstown, Md, facility will produce a two-seat combination helicopter and light airplane. Company has contract from Umbaugh Aircraft Corp, Ocala, Fla, for manufacture of

(Continued on p 204)

"I want you to know I have my eye on you, Walker — or is it Habbick?"

One order, one source

. . . every fastener need



Where strength is a factor

HOT FORMED NUTS

. . . Induction heated

Through induction heating and modern forming equipment, these Screw and Bolt nuts attain superior finish, wrenching qualities and tolerances.

The instant heating process eliminates cold working strains prevalent in conventional cold made nuts, minimizing oxidation. Then modern equipment forms these nuts to geometric perfection and exceptionally close tolerances . . . for secure, snug-fitting connections.

When rugged operating conditions exist, be sure . . . specify hot formed nuts by Screw and Bolt. Send for illustrated brochure. VMA 6733

SCREW AND BOLT CORPORATION OF AMERICA P.O. Box 1708 Pittsburgh 30, Pa.

Formerly Pittsburgh Screw and Bolt Corporation

SERVES THE NATION

America's Most Complete Line of Industrial Fasteners

MATTISON
HIGH-POWERED PRECISION
GRINDING METHODS

Mattison surface grinders outproduce cutter-type machining on parts like these

Stop Lever Bracket

MILL	GRIND
58 min	44 min

Table Guide

MILL	GRIND
12 min	4½ min

Roll Housing

MILL	GRIND
16 min	11 min

Motor Base Plate

PLAIN	GRIND
82 min	57 min

Lock Bar

MILL & GRIND	GRIND
44 min	24 min

Feed Control Plate

MILL & GRIND	GRIND
35 min	20 min

Table Guide

MILL	GRIND
16 min	9 min

Roll Housing

MILL	GRIND
17 min	11 min

CONTINUOUS CUTTING ACTION SAVES MONEY

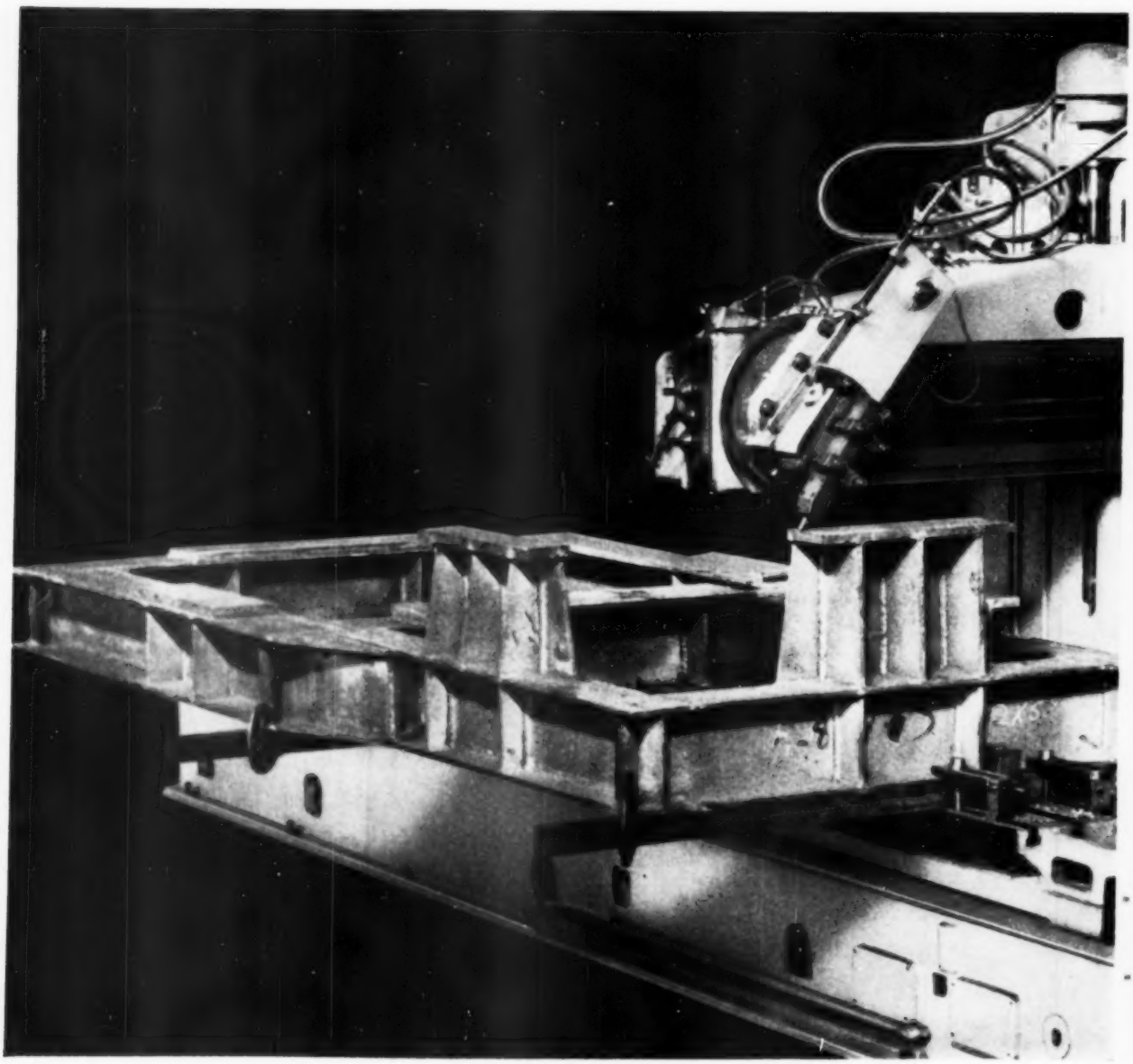
These jobs show how high-powered surface grinders speed stock removal (up to ¼ in. per side is economical) . . . with improvements in finish and accuracy. Real savings come from reduction or elimination of: scrap, downtime for tool changing and sharpening, setup time, fixture costs, and tool breakage. Ask for a test grind of your parts in our Methods Lab.

MATTISON MACHINE WORKS
Rockford, Illinois Phone WOodland 2-5521

MATTISON MACHINE WORKS
HIGH-POWERED PRECISION SURFACE GRINDERS

CIRCLE 295 READER SERVICE CARD

Nothing does the job like a...

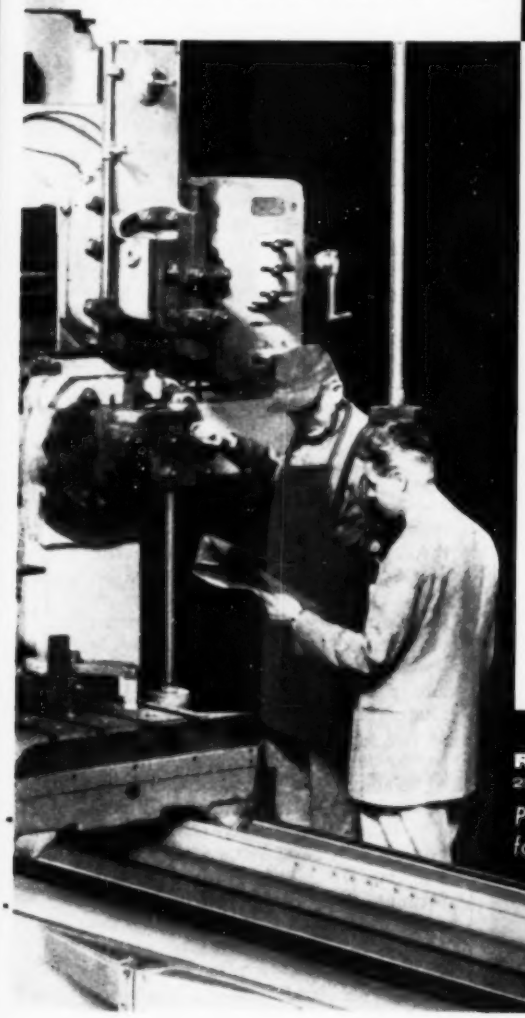


ROCKFORD

... PLANER

HYDRAULIC

MACHINES GENERATOR-BASE WELDMENT WITH LESS HANDLING AND SET-UP, IN ONE-THIRD NORMAL PRODUCTION TIME



Machining data:

Dimensions Weldment ..... 8'7" wide
.....15'3" long

Weight Workpiece .....5400 lbs.

Operation:
Planing top-side pads, highest pad 30½" from base of work.

Set-Up Time .....1st set-up, 1¼ hrs.,
.....2nd set-up, 1½ hrs.,
includes surface indication for continuation of cut.

Machining Time .....17¾ hrs.

Nothing performs like hydraulic power:

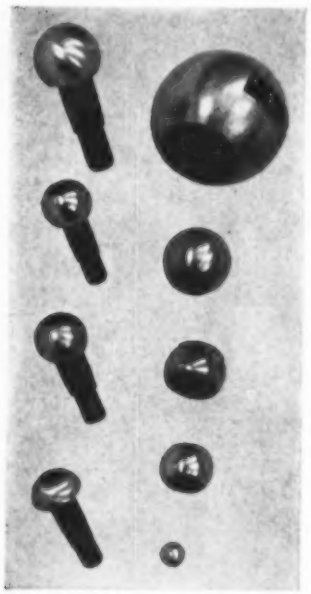
- Infinitely adjustable feeds and speeds;
- Smooth, uniform cutting pressures for finer finish;
- Maximum metal removal per H.P. expended;
- Low Costs for machining, cutting tools and maintenance.

ROCKFORD MACHINE TOOL CO.
2500 KISHWAUKEE STREET • ROCKFORD, ILLINOIS

Pioneers In The Use of Hydraulic Power for Reciprocating Machine Tools

WHY PROCESSING TRUNCATED SPHERES BY MICROMATIC METHOD IS FASTER, ECONOMICAL AND MORE ACCURATE

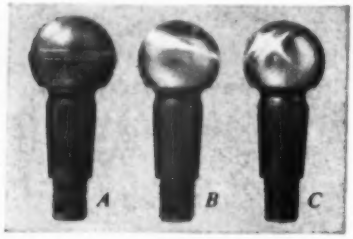
Machining of accurate truncated spheres has long been a design and production problem. The root of the problem lies in the fact that as a single point tool generates a spherical surface, the surface speed varies widely. To eliminate this problem, Micromatic has developed a fast, two-operation technique that assures uniform surface speed when machining any type of truncated sphere.



The above ball studs and other truncated spheres are typical of parts that can be processed faster, to closer tolerances and at lower cost with Micromatic machines and tooling.

First, a special cutting tool removes the bulk of excess stock from the forged part. For instance, here are the results obtained by a major automotive manufacturer: on a 1¼" diameter ball stud, approximately .060" of stock is removed from the ball in a 15-second floor-to-floor cycle. A finish of 40-60 microinches rms is obtained, total error in sphericity is held to .0005" and size is controlled within .001".

Microhoning is the second operation. In a 24-second floor-to-floor cycle, it removes final .002" of stock from the ball to generate required size, a finish of 6-10 microinches rms, sphericity within .0003" and a functional crosshatch lay pattern.



Typical ball stud processing—(A) heat-treated forging, (B) after Micromatic cutting tool operation, (C) finished ball stud after Microhoning.

See facing page for further details on how Micromatic processing of truncated spherical surfaces secures the above results.

MICROMATIC HONE CORP.
8100 SCHOOLCRAFT AVENUE • DETROIT 38, MICHIGAN

Field Report . . .

the Umbaugh-18 rotary-wing model. The wingless craft has a three-bladed rotor overhead, like a helicopter, and a pusher-type prop behind the cabin or main fuselage. For forward motion it uses the prop, powered by a Lycoming 180-hp piston engine. Lift is provided by the rotor, but unlike that in a helicopter, the rotor is not powered during flight. Contract calls for Fairchild to start tooling immediately and to begin production early next year.

Burroughs Gets $9 Million Order

Letter contract from the Air Force has authorized Burroughs Corp to begin work on an additional 36 SAGE units. Award represents new money that the AF has allotted the company to build the large-scale electronic devices at its Military Electronic Computer Division plant in Detroit. New contract brings to $155 million the total business Burroughs has contracted for in the program.

Network in the Troposphere

Page Communications Engineers, Inc, a Northrop subsidiary, has a $10 million contract to design and build a military channel tropospheric scatter telephone, teletype, and data communications network, linking the United Kingdom, Spain, and Morocco. Network would employ the beaming of radio signals toward the troposphere and stratosphere in such a way that far-distant sensitive receiving systems could pick them up with great reliability and clarity.

J&L's Huge Blast Furnace

New blast furnace, reported to be the largest ever constructed in the steel industry, will be installed at the Cleveland Works of Jones & Laughlin Steel Corp. Unit, which will cost in excess of $26 million, is a part of a $50 million expansion and cost reduction program, other phases of which include installation of two new basic oxygen steel-making furnaces which are also expected to be among the largest of their type in the world. Blast furnace will have a 32-ft hearth diameter, the working volume will be 65,000 cu ft, and unit will be 110 ft high. It'll have an ultimate daily rated capacity of 3500 tons of iron, and will increase the yearly rated iron capacity at the Cleveland Works by almost a million tons—from 866,000 to 1.8 million.

Argentina Buying Bubbles

Dunbalk Engineering Works, Ltd, Dublin, has started shipment of Meinkel bubble cars to the Argentine. Cars are being shipped unassembled. Dunbalk acquired manufacturing rights to the German bubble car last year, has since exported some 2000 (more than a million dollars' worth) to England and European countries. South American contract is for supply of about 8000.

DEK Industries Buys Rolle

Rolle Mfg Co, Lansdale, Penna, producer of aluminum and magnesium castings, has been acquired as a subsidiary by DEK Industries, New York - headquartered manufacturer of aluminum products with manufacturing plants in Los Angeles, Atlanta, and Downingtown, Penna. Rolle makes castings for rockets, missiles, aircraft, aircraft engines, and components for the automotive and electronic industries.

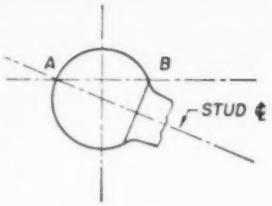
Westinghouse Gun-Parts Orders

Westinghouse Electric Corp's plant at East Springfield, Mass, has received $665,000 worth of orders for machine gun and rifle parts from Saco-Lowell Shops automotive division and Harrington & Richardson Co, Worcester. New contracts could mean some slowing down in layoffs at the plant where operations are being curtailed as company transfers manufacture of room air conditioners, water coolers, and dehumidifiers to its Columbus, Ohio, facility. About 400 employees have already been laid off at the plant, reducing

"Mr. Wurple, we need more light in the parking lot . . . last night I tripped and fell over a foreign car."

HOW PROCESSING TRUNCATED SPHERES BY MICROMATIC METHOD ASSURES ECONOMY, SPEED AND ACCURACY

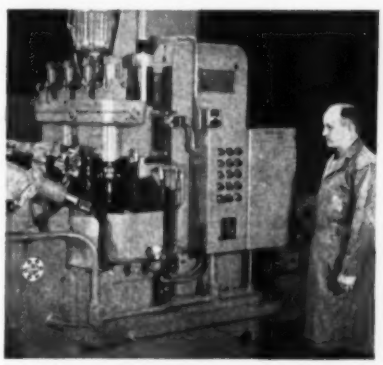
As an example, here's how Micromatic equipment in two fast operations machines 1¼" diameter forged ball studs. For both operations, the ball stud is located on the taper, clamped in the thread and positioned on an inclined axis. Thus the center of the ball crown (A) and the intersecting point of sphere and shoulder (B) are in a horizontal plane.



FIRST OPERATION: *Cutting excess stock from forged ball stud.*

The first machining of ball stud is a cutting operation. A special Micromatic cutting tool, that is U-shaped at the cutting end, is used to assure constant cutting speed over every point of the ball. Two round carboloy blades are clamped in the tool—clamp also acts as a chip breaker. With blades positioned in a counterbore, no adjustments are required. Size is controlled within .001" by depth of feed, set by an adjustable stop. Blades may be turned or reversed to give several usable cutting faces. Also, since they are throw-aways, these blades offer additional economies. Approximately 2,000 balls are machined with each set of blades. In a 15-second floor-to-floor cycle, the cutting operation is completed—total error in sphericity is held to .0005".

The ball is then Microhoned. The combination or rotating motions of workpiece and the special Microhoning tool results in a functional cross-hatch lay pattern and makes the abrasive self-dressing. In a 24-second floor-to-floor cycle, Microhoning generates required size, sphericity within .0003" and a finish of 6-10 microinches rms.



SECOND OPERATION: *Microhoning ball stud to secure final size, sphericity and finish. Single spindle machines also available.*

For Further Information, Write To:

MICROMATIC HONE CORP.
8100 SCHOOLCRAFT AVENUE • DETROIT 38, MICHIGAN

Daddy isn't the boss...

He's just in charge of putting gears in the machines. But he doesn't growl anymore when he comes home. Mommy says he doesn't worry now about bad gears and not getting them on time since they buy them from CINCINNATI GEAR.

Why not investigate the advantages of having your gears and gear boxes made to suit your needs exactly? CINCINNATI gears are precision made, precision inspected, GUARANTEED—with delivery dates as promised. Ask us to quote on your requirements.

CINTI

THE CINCINNATI GEAR CO.

Wooster Pike and Mariemont Ave. Cincinnati 27, Ohio
Custom Gear Makers Since 1907

GEARS, good gears only

Field Report . . .

the work force to 2100, and an additional employment reduction of 1000 has been planned for mid-October. New contracts will mean "more work for people here, especially tool and die makers and skilled machinists," company reports.

$10 Million Plastics Plant

Montecatini, one of Italy's largest manufacturers of metals, chemicals, and plastics, will build its first American plant on a 200-acre site on the Big Sandy River near Huntington, West Virginia. Products will include a series of polypropylenes. Facility is scheduled for completion in two years and will have an initial labor force of 200.

Glasrock Corp Booming

Glasrock, a relatively new Atlanta firm, is getting set to put up its third plant to meet rapidly increasing demand for its product in aeronautical and astronautical applications. Company has just received an $800,000 order from Lockheed for the material for use in building the B70 bomber on which Lockheed is a subcontractor for North American Aviation. Glasrock is a ceramic material which will serve as liner material in a furnace where the metal honeycombs are soldered to steel plates to form fuselage sections of the bombers. Product has also been successfully tested by Redstone Arsenal as rocket nose cone material and has been considered as a possible solution to the problem of reentry.

On Mark is Set, Goes

On Mark Couplings has made its fourth plant expansion in its short three-year history with the opening of new engineering and sales quarters in Los Angeles. Relocation of these departments to a separate 4000 sq-ft office will allow a planned further expansion of its production and assembly departments. Firm makes flexible and quick disconnect couplings, rigid tube unions, and custom valves used in missiles and aircraft.

DataGraphic Goes International

Nine months after its California incorporation, DataGraphic Systems, Inc, a newcomer in the microfilm and data handling field, is boosting its capitalization from $100,000 to $1 million and broadening operations from regional to international scope.

Company, which is jointly owned by Douglas Aircraft and General Aniline & Film Corp, has acquired rights in the marketing and world-wide distribution of all Ozalid Microline products, and of Ansco's well-known silver halide microfilm. Sales offices and staffs of the two parent companies in more than 35 international locations will cooperate with the new company in its marketing programs. DataGraphic began business last January to develop and market machines, materials, techniques, and systems in the field of microfilm miniaturization and data handling.

Ford in Argentina . . .

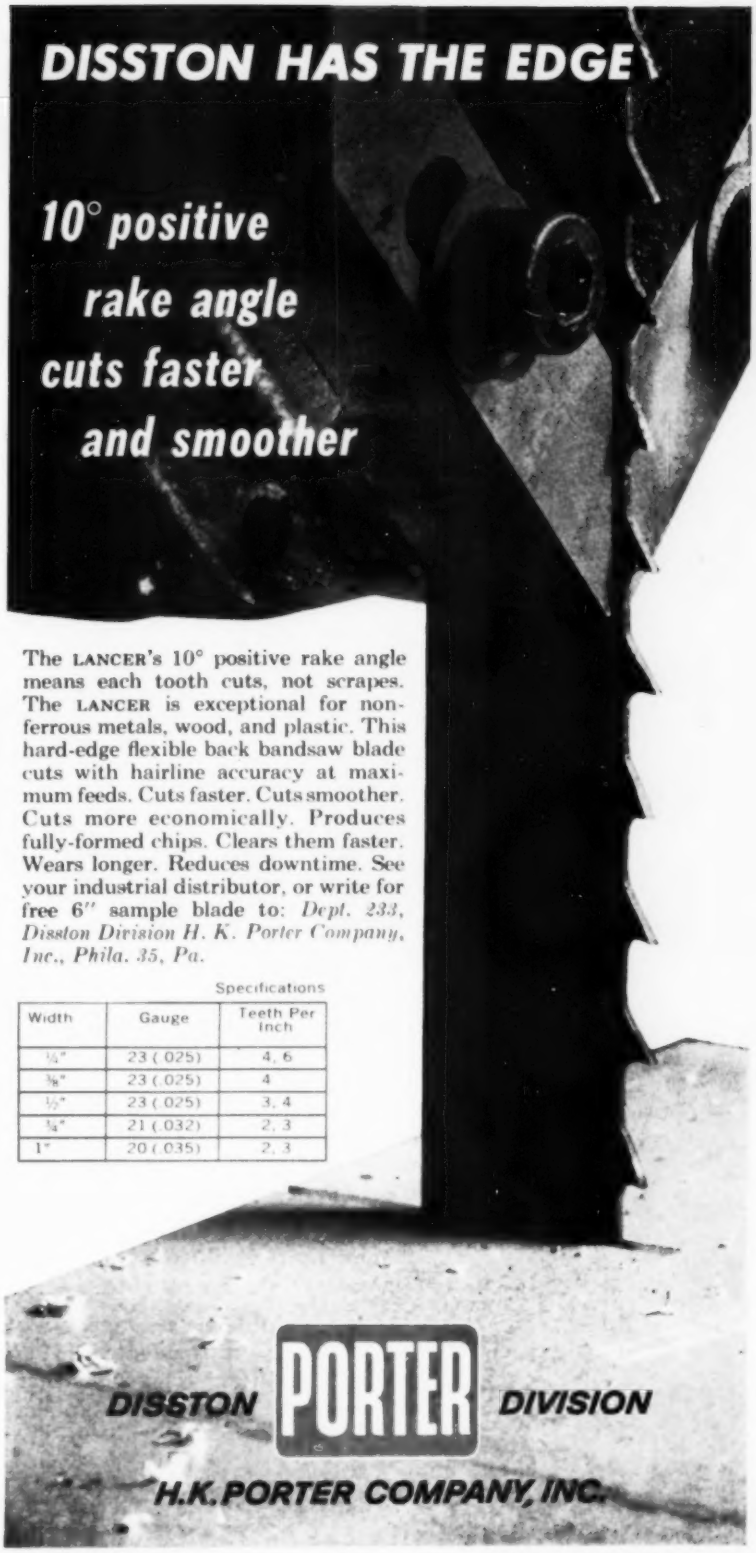
. . . will be turning out 1000 trucks monthly early next year, according to D B Kitterman, general manager of Ford's Argentine subsidiary. Work on the new factory is well advanced; first units, composed of 45% domestically manufactured parts, will be on sale next November.

Robinson-High Vacuum Merger

Robinson Technical Products Inc, Teterboro, NJ, manufacturer of Met-L-Flex vibration mountings, has acquired all of the outstanding shares of High Vacuum Equipment Corp, Hingham, Mass. Merger joins two companies which have been engaged for a number of years in furnishing specialized equipment used extensively in the aircraft, guided missile, electronics, and commercial fields. High Vacuum, which will be operated as a Robinson subsidiary, designs and manufactures a wide variety of specialized high vacuum-

(Continued on p 210)

"The grievance committee must have a beaut this time!"


DISSTON HAS THE EDGE
10° positive
rake angle
cuts faster
and smoother
The LANCER's 10° positive rake angle means each tooth cuts, not scrapes. The LANCER is exceptional for nonferrous metals, wood, and plastic. This hard-edge flexible back bandsaw blade cuts with hairline accuracy at maximum feeds. Cuts faster. Cuts smoother. Cuts more economically. Produces fully-formed chips. Clears them faster. Wears longer. Reduces downtime. See your industrial distributor, or write for free 6" sample blade to: Dept. 233, Disston Division H. K. Porter Company, Inc., Phila. 35, Pa.
Specifications
Width | Gauge | Teeth Per Inch
½" | 23 (.025) | 4, 6
⅜" | 23 (.025) | 4
½" | 23 (.025) | 3, 4
¾" | 21 (.032) | 2, 3
1" | 20 (.035) | 2, 3
DISSTON PORTER DIVISION
H.K. PORTER COMPANY, INC.

PORTER SERVES INDUSTRY: with Rubber and Friction Products—THERMOID DIVISION; Electrical Equipment—DELTA-STAR ELECTRIC DIVISION, NATIONAL ELECTRIC DIVISION; Specialty Alloys—RIVERSIDE-ALLOY METAL DIVISION; Refractories—REFRACTORIES DIVISION; Electric Furnace Steel—CONNORS STEEL DIVISION, VULCAN-KIDD STEEL DIVISION; Fabricated Products—DISSTON DIVISION, FORGE AND FITTINGS DIVISION, LESCHEN WIRE ROPE DIVISION, MOULDINGS DIVISION, H. K. PORTER COMPANY de MEXICO, S. A.; and in Canada, Refractories, "Disston" Tools, "Federal" Wires and Cables, "Nepcoduct" Systems—H. K. PORTER COMPANY (CANADA) LTD.

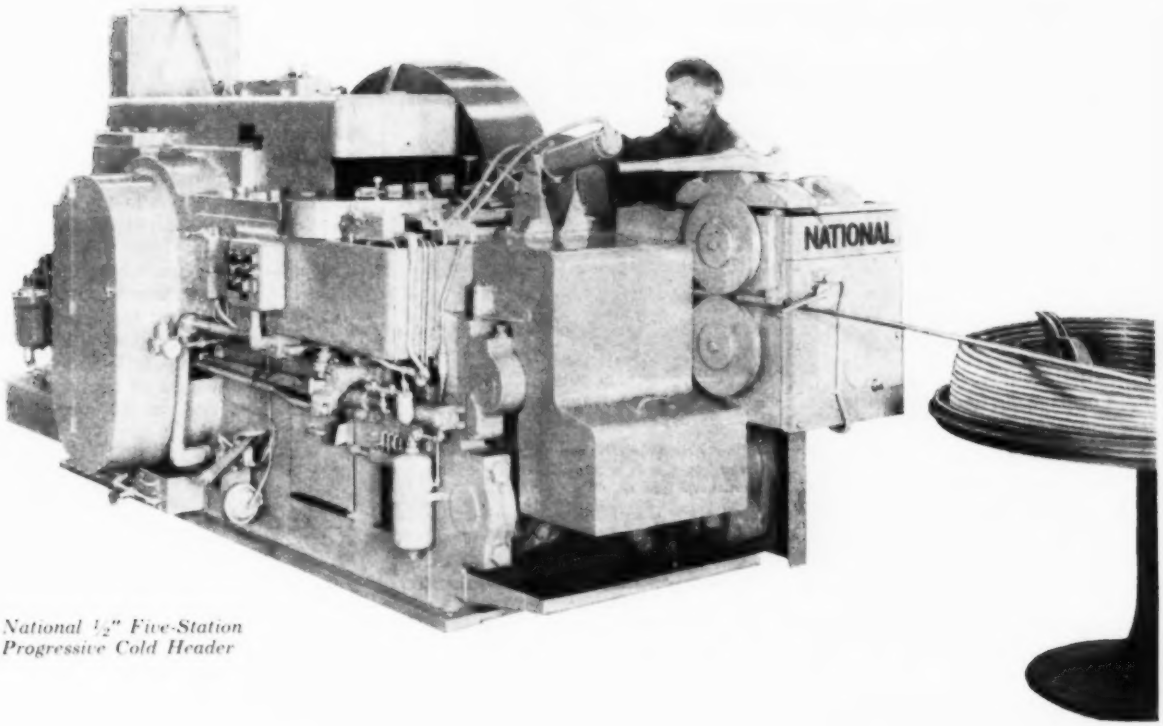
Top row, left to right: piston pin, wheel nut, ball stud, pump shaft, faucet stem.
Middle row: spark plug body, eye bolt, shuttle tip, ball socket, universal joint bearing cup, splined square-head shaft.
Bottom row: tube nut, tappet plunger, hollow rivet, blind rivet, distributor cap insert, commutator bar.

These are typical parts you can make to advantage, not by wasteful cutting, but by *cold heading* — flowing metal into accurate shapes. All of the above jobs, with one exception, were made complete from coiled wire to finished part, without intermediate annealing and coating, *in one compact machine!*

Why are formerly difficult-to-head jobs like these not only possible now, but commercial? The answer is teamwork, on many fronts. For example:

(1) More versatile metals are now available in coiled wire. (2) Die materials and lubricants are still better. (3) We are getting important (to us) but usually insignificant concessions from cold-heading-minded parts designers. (4) National Cold Headers, multiple-die Progressive Headers, Cold Formers

The modern way to make Metal Parts faster, stronger, to amazingly close dimensions!



National ½" Five-Station Progressive Cold Header

and Boltmakers, backed by our fast-growing engineering experience, are now specially equipped to produce reliably the formerly difficult jobs like these shown here.

Are your production problems like these? Perhaps cold heading could pay off for you in a remarkably short time. Let's find out.

Here is our service to metalworking, and you are under no obligation to buy. Send us samples or prints of your jobs. Better yet, bring them to Tiffin where more of our experienced people can participate in *your* problem.

We shall be happy to work with you in developing that better method.

Founded 1874—DESIGNERS and BUILDERS of MODERN FORGING MACHINES • MAXIPRESSES • REDUCEROLLS • COLD HEADERS BOLTMAKERS • NUT FORMERS • TAPPERS • NAILMAKERS CO-PIONEERS WITH INDUSTRY OF ADVANCED METALWORKING PRODUCTION METHODS

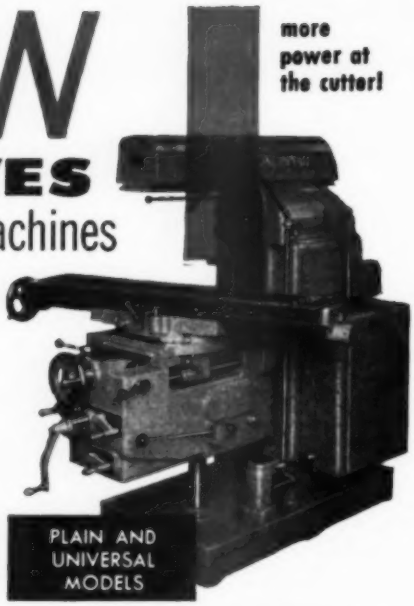
NATIONAL MACHINERY CO.

TIFFIN, OHIO, U. S. A.

HARTFORD DETROIT CHICAGO

new GREAVES 2-XH Milling Machines

more power at the cutter!



The completely new GREAVES No. 2-XH Milling Machine brings added versatility, increased operational ease, and more power where it's needed most . . . *at the cutter!* It utilizes two motors, one for spindle drive; a separate motor for moving table, saddle and knee. Compare this and the other outstanding features of the new Greaves Mill. You'll see why Greaves is "The MOST Mill for the LEAST Money."

Write for detailed literature!

- Wide range of speed/feed combinations for any type material, any type job.
- Heavy, internally ribbed column casting and heavy duty rectangular overarm for maximum rigidity.
- Large, heavy-duty knee, saddle and table provide accuracy for all types of milling.
- New 7½ HP spindle drive motor, with separate motor for movable components, provides extra power for heavy milling.
- Easy-to-reach controls. Handwheels and vertical crank disengage automatically when not in use.
- New rapid traverse lever within operating control area.
- Separate drive motor for table, saddle and knee provides more smooth balanced power at the cutter.

GREAVES

J. A. FAY & EGAN COMPANY
2100 Eastern Avenue, Cincinnati 2, Ohio

CIRCLE 304 READER SERVICE CARD

Field Report . . .

high temperature furnaces and associated equipment, including electron beam welders, metallizers, and vacuum pumps.

Magnetic Amplifiers Expands Line

New devices designed to furnish power for computers and other equipment will be added to the product lines of Magnetic Amplifiers, Inc, New York electronics firm. Called solid state static inverters, new power supplies are reported to be more efficient and reliable, in addition to being lighter and smaller than conventional devices performing the same function. They contain no moving parts, are capable of withstanding temperature extremes, vibration and shock, and are said to outlast the equipment with which they are used. Other applications for the power supplies are in the field of industrial automation.

New Titanium Fabricator

Vulcanium Corp, recently formed to manufacture titanium assemblies and corrosion-resistant equipment for metal finishing and industrial applications, has opened its new factory in Highland Park, Ill.

Precision Disc Grinding Corp . . .

. . . Mineola, NY, contract grinding firm, has opened a West Coast division under the name of Precision Disc Grinding of Calif, Inc, in Inglewood, Calif. New division will serve the Coast in double disk grinding, flat lapping, and other machining services.

(Continued on p 214)

From the *American Machinist* Library of *Tips for Top Shop Men*

BE sure your machine tools don't spend most of their "working" day as layout tables. A machine tool earns its keep only when it is cutting metal. Jobs can be set up on a surface plate or bench by someone else—frequently someone better at setup than the machine operator.

"Hold the line. I'm circling number 3298 on the Reader Service card."

CIRCLE 306 READER SERVICE CARD ►

A NEW ERA IN RELAY LIFE AND RELIABILITY!

A-B QUALITY

THEY MAY LOOK ALIKE, BUT

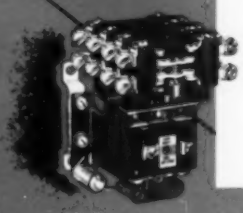
these new relays completely outmode the usual concepts of relay life and reliability.

For years the Allen-Bradley Bulletin 700 Type B and Type BX relays have been preferred for their long life and their consistent, trouble free operation. In having produced millions of these relays, we learned how to improve them. Thus, the new line of Type B and Type BX relays was designed to set a new level of performance standards.

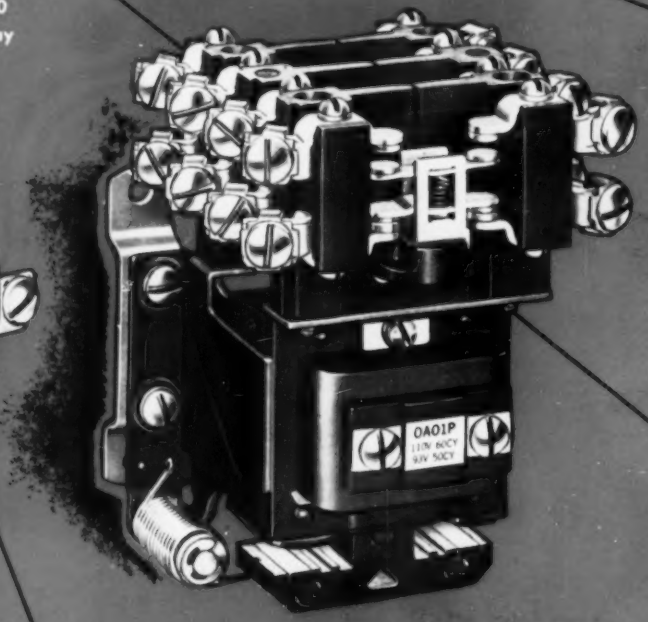
Turn the page and see the outstanding features of these new Bulletin 700 Type B and Type BX relays. For the same price, they offer you even greater value, greater reliability.

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

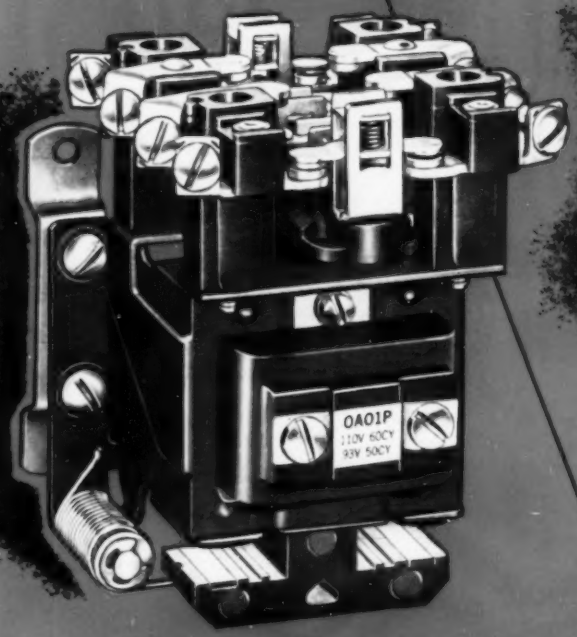
old Bulletin 700
Type B-400 Relay
with 4 N.O. contacts



old Bulletin 700
Type BX-440 Relay



new Bulletin 700, Type BX-440A
AC Control Relay can be wired for normally open or normally closed contacts



new Bulletin 700, Type B-220A
AC Control Relay with 2 N.O. and 2 N.C. contacts

ALLEN-BRADLEY
Member of NEMA
QUALITY MOTOR CONTROL

7-59-MR

NEW BULLETIN 700 RELAYS

TYPE B AND TYPE BX

provide these improved features

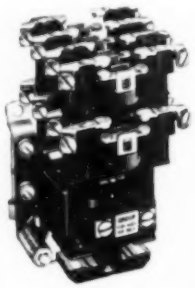
1. New mechanical design gives *at least* 5 times greater operating life.
2. New contact motion provides 10 times greater electrical reliability.
3. Compact construction—new relays are structurally improved with no change in size.
4. Complete interchangeability. Mounting dimensions of new relays have not been changed.
5. Rugged, high efficiency cast plastic coil. New, improved coil fits *all* Bulletin 700 relays.
6. New, stronger, movable contact crossbar—fits Bulletin 700 relays now in service.
7. Improved stationary contact blocks. These new blocks can also be used on present models of the Bulletin 700 relay.
8. Increased life and reliability—*no increase in cost.* These new, improved relays are priced the same as previous Allen-Bradley models.
9. The letter A is added to the Bulletin 700 relay type number merely to distinguish the new line.
10. These new relays are Allen-Bradley's "thank you" to our many customers who have bought millions of Bulletin 700 relays over the years.

A-B QUALITY

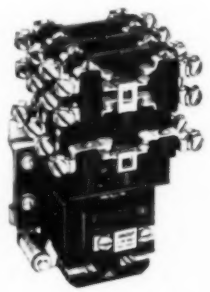
The old Bulletin 700 relay was first placed on the market some 25 years ago. Today, millions of these relays are in daily service—all over the world.

None of the old relay "values" have been lost in the new designs. Instead, these "values" have been greatly improved. The new relays feature a simplified, longer life, solenoid construction. The double break, silver alloy contacts are the same—always in perfect operating condition—without cleaning or filing. The operating coil has been greatly improved—it cannot be damaged by atmospheric conditions, no matter how severe.

No one can deny the popularity of the older Bulletin 700 relays. The new relays—with their superior features—will be an even better answer for any and all relay applications.



TYPE B, GENERAL PURPOSE
Bulletin 700, 8-pole relay. Made with 8 N. O. and no N. C., or up to 4 N. O. and 4 N. C. contacts.



TYPE BX, UNIVERSAL
Bulletin 700, 8-pole relay with both N. O. and N. C. contacts. Changeover is made by reconnecting incoming lines.

HERE IS ANOTHER REMARKABLE ADDITION TO THE ALLEN-BRADLEY RELAY LINE

It's new . . . and it's different. This unusual Bulletin 700 convertible contact relay has contacts that can be changed from normally open to normally closed operation (or vice versa)—in just moments. A screwdriver is all it takes to do the job—no additional parts are needed. Like all A-B relays, it's good for millions of trouble free operations. Watch for announcement and full details of this new convertible relay soon!

ALLEN-BRADLEY

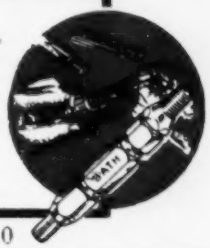
Member of NEMA

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wisconsin
In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

7-59-MR

QUALITY MOTOR CONTROL

BATH *Tap'n Gage* TIMES



A series of technical discussions that will be helpful in getting better results from tapping and gaging operations

Vol. 1 No. 10

Subject: Common Types of Standard Taps:

Taps are available to the trade in many sizes and styles as stock items. It is really *customer demand* that determines what kind of taps are generally regarded and listed as STANDARD TAPS. These taps are readily available and are priced economically because of optimum manufacturing quantities. While most tap manufacturers make STANDARD TAPS to the same dimensions, individual company refinements in design and processing are such that STANDARDS made by different manufacturers vary just as much as specials.

STANDARD HAND TAPS

Although still known as hand taps, most of these taps are used today in machines on production. They are available in the common sizes from ¼-20NC through 1½-12NF. Usually they have four flutes, but in some sizes two, three and six are popular. These are the "work horse" or general purpose taps. They are also supplied for specific materials when ordered.

STANDARD MACHINE SCREW TAPS

These taps are the common sizes below ¼" and begin with 0-80NF which has a basic nominal size of .060, increasing by increments of .013 or multiples through 14-24NS, with .242 as a basic nominal size. These are the "work horse" or general purpose taps and are available in a number of flute options. They are also supplied for specific materials when ordered.

SPIRAL POINTED TAPS

The spiral pointed tap gets its name from the angular grind at the front of the flute. This feature forces the chips ahead of the tap which makes the design most suitable for through holes or holes where ample space is provided for chip collection. They are available in the common machine screw sizes from 0-80NF through 14-24NS and in the common hand tap sizes from ¼-20NC through ½-20NF.

SHORT FLUTE SPIRAL POINTED TAPS

These rugged taps are designed for tapping punched holes, sheet metal and other thin sections of not more than one diameter or the length of the spiral point. They are available in the common machine screw sizes from 3-48NC through 12-28NF and in the common hand tap sizes from ¼-20NC through ½-20NF.

HELICAL FLUTED TAPS

These taps are distinguished by the right hand helical flute feature designed to eject chips from the tapped hole. They are most effective in material that produces long, stringy, curling chips when tapped. They often are superior to straight fluted taps in holes with keyways, slots or gaps. They are available in the common machine screw sizes from 3-48NC through 12-28NF and in the common hand tap sizes from ¼-20NC through ½-20NF.

OVERSIZE MACHINE SCREW SIZES

These taps are designed for tapping die castings, plastics, bakelite and other abrasive materials. Being .002 larger than regular taps, they allow for plating and heat treating and produce large holes for ease of assembly. They are available in 6-32NC, 8-32NC, 10-24NC and 10-32NF with regular flutes and spiral point.

TAPER PIPE TAPS

These taps are generally used for pipe fittings and couplings although there are some other applications. They are available in sizes 1/16-27 through 2-11½ regular and interrupted thread with the following pipe thread forms:

NPT American Standard Pipe Form

NPTF American Standard Dryseal Pipe Form

ANPT Aeronautical Pipe Threads

STRAIGHT PIPE TAPS

These taps are used for tapping couplings, lock nuts and other straight pipe fittings. They are available in sizes 1/8-27 through 1-11½ with the following pipe thread forms:

NPS, NPSC, NPSM — American Standard Pipe Form

NPSF through ½" — American Standard Dryseal Pipe Form

For complete tap information fill in and mail coupon TODAY for your BATH catalog.

John Bath & Co., Inc., 22 Mann Street, Worcester, Mass.

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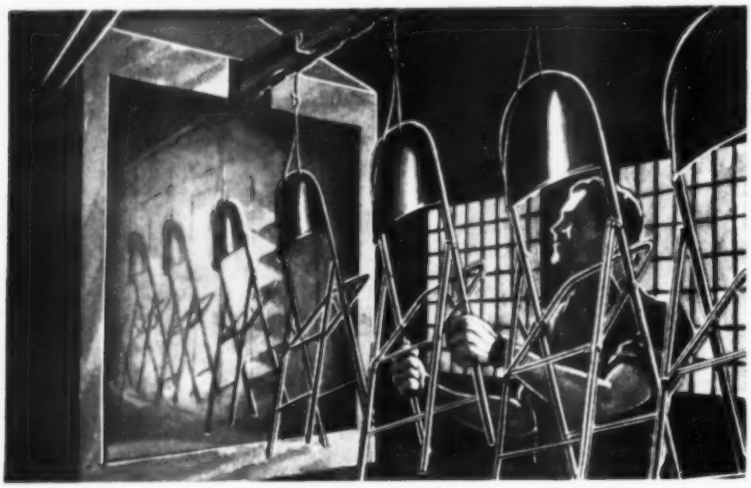
ask Oakite

OVER 50 YEARS CLEANING EXPERIENCE • OVER 250 SERVICE MEN • OVER 160 MATERIALS



Even the highest spray washer pressures won't foam Oakite 161 alkaline detergent

Turn on the highest pressures to speed cleaning—you won't get any foaming problems with Oakite 161. Nor any etching problems, either. This alkaline detergent is specially designed for *safe* pressure spray washing of any metal—aluminum, white metals, brass, steel.

And it does a thorough job. Oakite 161 blasts off identification inks, grease, oil and shop soils . . . gives a completely clean surface for inspection or final finishing. Costly? Not at all. Extra long solution life and low concentrations assure low per-unit production costs.

One of a complete line of Oakite products for spray washers, Oakite 161 is complemented by heavy-duty solvent cleaners, moderate to light-duty alkaline materials. Ask the Oakite man to help you make the choice that's right for your washer . . . right for your products. Or send for Bulletin F-9773. Oakite Products, Inc., 24 Rector Street, New York 6, N. Y.

it PAYS to ask Oakite

OAKITE

50 1909-1959 years' leadership in industrial cleaning

SCIENCE

Field Report . . .

New IBEC Arkansas Plant

Manufacturing and assembly plant in West Memphis, Ark, will be put up by the Bellows Co, Valvair Corp, and Sinclair-Collins Valve Co, all of Akron, comprising the Fluid Power Divisions of International Basic Economy Corp. The three companies manufacture and distribute pneumatic, hydraulic, and electrical components for industrial applications in automating metalworking, textile, plastic, and other manufacturing processes.

AiResearch Phoenix Expands

The aviation component firm, a division of Garrett Corp, has acquired 33 acres of land and 155,000 sq ft of plant and office area from the Babb Co, immediately adjoining the existing AiResearch plant on Sky Harbor Airport, Phoenix, Ariz. Addition will house current growing projects as well as supply space for planned expansion during the next five years. No immediate change in the number of employees is anticipated; workforce now totals 3700.

H I Thompson Fiber Glass Co . . .

. . . manufacturer of high temperature insulating materials and industrial plastics, has taken over certain of the assets and businesses of Omega Design Associates and Astro Plastics Co, both of Long Beach, Calif. Omega, a machine and tool company, fabricates metal parts for aircraft and missiles, has an annual sales volume of $2 million. Astro makes radomes for ground and air for the government, currently has a $1.5 million backlog.

Aluminum Co of Canada, Ltd . . .

. . . after some soul searching, has decided to suspend indefinitely its magnesium producing facilities. The magnesium plant, which has operated as a minor division of Alcan's aluminum smelting facilities at Arvida, Que, has an annual capacity of 4000 tons of magnesium ingot. In recent years the plant has operated at rates substantially below capacity, producing magnesium mainly for export to world markets.

GE is Adding . . .

. . . a $1 million addition to its capacitor plant at Irmo, SC. Facility will be used in an attempt to produce an electrolytic capacitor with a max failure rate of one in 100,000 capacitors.

Stanley Building in Crocker Park

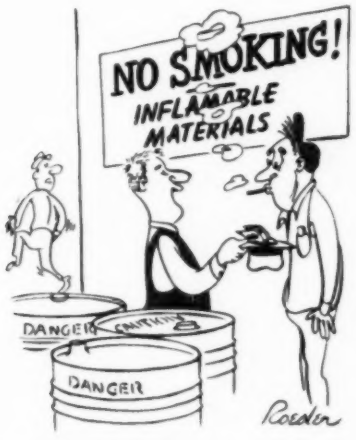
Stanley Works, 117-year-old New Britain, Conn, maker of industrial and builders' tools, will be the first company to locate in the new Crocker Industrial Park, just outside of San Francisco. It'll start construction this month of a 45,000 sq-ft office and warehouse building on four acres of land in the Park. The new $300,000 building will house regional sales and warehouse operations of the Stanley hardware division to cover California, Washington, Oregon, Arizona, Nevada, and Utah. Sales offices of the electric tools and the Stanley-Judd drapery hardware division will also be located in the facility.

Lockheed's Last T-33 Sets Record

Record for the longest single-model aircraft building program in jet aviation history was established with delivery by Lockheed of its final T-33 jet trainer to the Air Force. In continuous production since 1948, there've been 6691 of the T-33s turned out with total dollar value of $570 million. Manufacturing economies achieved during the record assembly-line run reduced production time for the final T-33s to about 1/25 that required for the first F-80 from which the trainer was derived.

Babcock & Wilcox Co...

. . . has a contract from CAMEN, an Italian Government-owned research and training agency, to supply the core and nuclear hardware for Italy's third research reactor. It'll be used for the training of Naval



"We're taking a collection for a fellow-employee who is not in the hospital — YET!"

New:

Hanson-Whitney's new production techniques give you *consistent* quality cutting edges with *"free-cutting action"* for increased productivity. These advances in Hanson-Whitney standard cutting tools mean longer tool life—uniform size and less binding. And you protect your threading investment from start to finish, with Hanson-Whitney's *related* line of standard Thread Gages—keeps your profit dollars up, where they ought to be.

Complete and Related "STANDARDS"

Your Hanson-Whitney distributor puts a *complete and related* line of standard *"free-cutting action"* tools and gages at your finger tips. He is your threading specialist backed up by Hanson-Whitney's forty years of thread engineering and experience. Call him now.

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COMPANY
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STANDARD: Taps • Thread Gages • Cutters • Fine Pitch Gear Hobs

YOU DON'T HAVE TO BABY CARMET CARBIDE TOOLS

—on short or long runs!

A full range of Carmet Carbide cutting tools are available to answer every cutting need . . . and allow you to cut with profit. The Carmet Carbide Tips are carefully brazed to alloy steel shanks, strong, tough and beefed up in design to support the carbide.

Full guidance in selecting the proper grade, assistance in selecting the proper tool, is available locally from your Carmet Distributor. He stocks a full line, is there to serve you. Call on him or the Carmet Service Engineers whenever they can help. Carmet Division, Allegheny Ludlum Steel Corporation, Detroit 20, Michigan.

USE THIS CARMET GRADE SELECTION CHART

. . . then machine at optimum feeds and speeds

Carmet Grade	Application	Industry Designation
CA-3	For heavy machining of cast iron and nonferrous material. 300 series stainless.	C-1
CA-4	Machining cast iron and nonferrous material. 300 series stainless.	C-2
CA-604	High Velocity finishing.	C-8
CA-605	Precision boring steel. Light, fast cuts.	C-8
CA-606	Light, fast machining on steel, stainless and high temp. alloys.	C-7
CA-608	Light to medium-heavy machining on steel.	C-7
CA-610	General machining on steel. Heavy roughing cuts.	C-6

WBW 7852 A

FREE NEW CARMET CATALOG

This 32-page first edition contains prices and complete specifications on Carmet's full line of cemented carbide tipped tools, Indexable Inserts, blanks and holders. Speed and feed charts, grade comparisons and ordering information included.

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CARMET

CEMENTED CARBIDE DIVISION OF
ALLEGHENY LUDLUM STEEL CORPORATION

Field Report . . .

Academy and University of Pisa engineering students. Located midway between the Academy in Livorno and Pisa, the reactor will be of the pool type, designed to operate at 5000 kw capacity. It will go into operation early in 1961.

Formed Tubes to Build in Ala

Formed Tubes, Inc, Sturgis, Mich, manufacturer of fabricated steel tubing, is starting construction of a plant at Haleyville this month. Located on a 300-acre site, facility will contain 54,000 sq ft of manufacturing space and 5000 sq ft of office space. Operation is scheduled to begin next spring.

Solar Closing Des Moines Plant

Solar Aircraft Co's Des Moines plant will be closed and the factory buildings sold; all company operations will be shifted to the main facility in San Diego, Calif, which employs 2350. The Iowa plant employed about 1000 workers, mainly engaged in high volume production work on jet engine components. Decline in this work forced the shutdown, company states. Some of the work will be transferred to San Diego, and some will be phased out.

Westinghouse Electric's . . .

. . . Aviation Gas Turbine Division in Kansas City, Mo, has new orders totaling $5.9 million for jet engine spare parts for the Navy. Late in July the Navy office in Philadelphia ordered $1.5 million worth of parts, making a total of well over $7.5 million booked at the jet plant in six weeks.

(Continued on page 220)

"There's no rush on it, Al—take all night, if necessary."

CUT TIME! CUT COSTS!
CUT ALMOST ANYTHING
IN SECONDS!
No. 20 Manual-Operated Model
No. 14 Power-Operated Model
Speed Cut
Abrasive Cutting Machines-MANUAL OR POWER-OPERATED MODELS FOR WET, DRY OR ANY-ANGLE CUTTING!
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Send for complete catalog and name of nearest distributor
ABRASIVE MACHINE DIV.
BEAVER PIPE TOOLS, INC.
DANA AVE.
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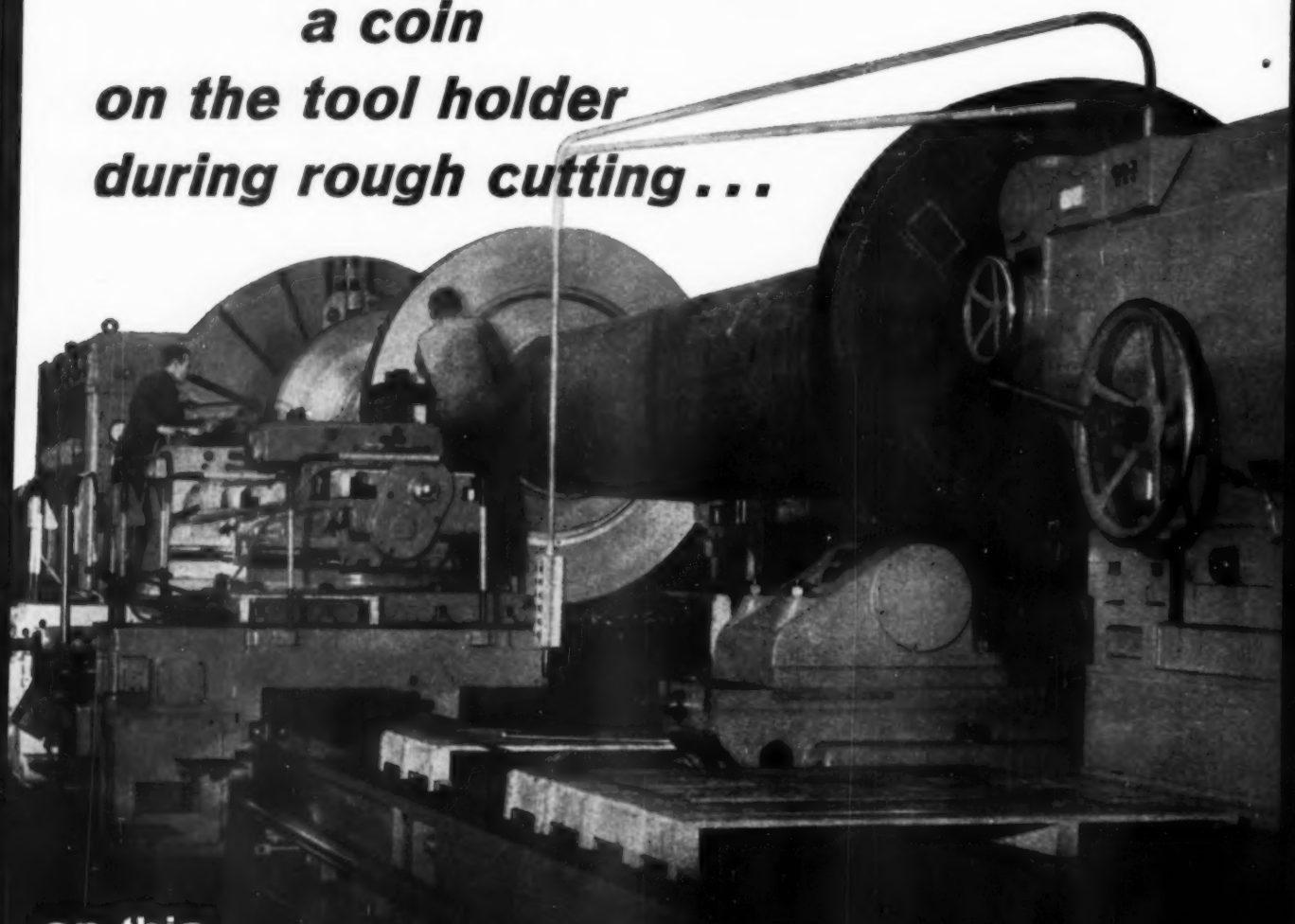
you can balance
a coin
on the tool holder
during rough cutting . . .



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waldrich high speed lathe

Series WSD

- Rigid construction insures vibration-free operation with carbide tools.
- Maximum utilization of horsepower in main drive
- Rugged headstock
- Heavy duty tail stock
- 3-way and 4-way bed design
- Fast, efficient chip collecting

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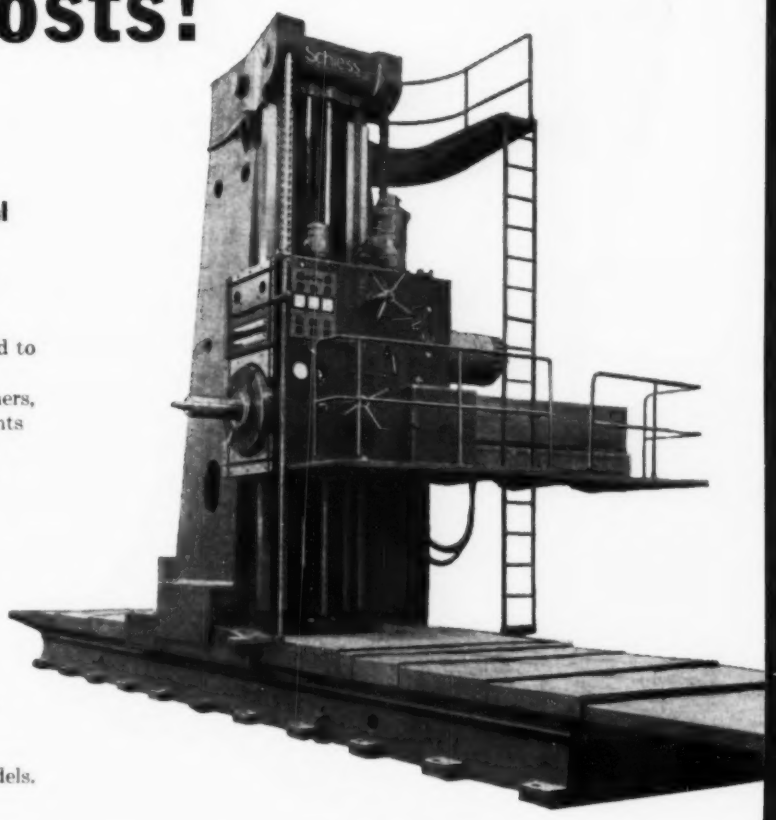
watch these giant workers chip away costs!

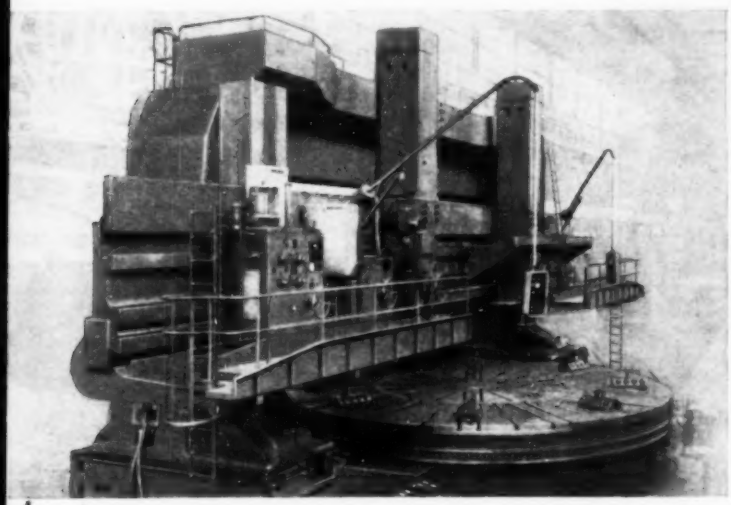


This 8⅞ in. SCHIESS model BF horizontal boring and milling machine . . .
now completely redesigned with many innovations. Here are a few . . .

Two individual drives—gear-drive for roughing, belt-drive for finishing. Belt-drive particularly suited to high-speed machining with carbide tools. New tool clamping device—does away with draw keys, hammers, drifts and binding screws. All spindle-slide movements controlled from easily accessible operating platform (or from pendant station or portable control panel, if desired). Special main-drive belt requires no readjusting. Column, spindle-slide and boring spindle may be adjusted at rapid traverse.

Spindle diameters, 6-5/16″ to 8-7/8″. Maximum diameter bored, 59″—faced, 79″.

It takes Europe's largest builder of heavy machine tools, Schiess, to turn out giants like these. Parts and service as close as Pittsburgh. And an American Schiess engineer will be happy to help you size up these heavy producers for your heavy production needs. Write for catalogs and complete specifications on all Schiess BF and K models.



This 32 ft. SCHIESS model GK vertical boring and turning mill . . .
Look at all these new features of the most modern vertical boring mill of its type: Two ram heads on the rail, one of which is tracer-controlled. One milling head on the rail which can be parked on the left side rail extension. Dual tables—one 15′ table on the inside, a 32′ table on the outside. Each table has independent drive, or both tables can be used together and synchronized as one. Table equipped with indexing device to be used for indexing layout work. Machine will swing a maximum diameter of 40′. Rapid traverse motions with pushbutton control of changeover from feed motion to independent power traverse. Electro-mechanical locking of cross-rail to columns. Fingertip speed control—counter-balanced cross-rail and side-head—completely enclosed swiveling octagon rams—pendant control—automatic lubrication.

Have you ever seen anything like it?

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Field Report . . .

Dresser Moving Turbodrill Plant

Turbodrill Division of Dresser Industries, Inc, will be moved from its present location on the grounds of the Guiberson Corp, one of the Dresser Industries in South Dallas, to the Dallas plant of the company's Security Engineering Division. The Turbodrill Div has been working for three years on improving the turbine mechanism of the drill; most of this work has been done at the Guiberson plant which has large facilities for rubber molding. At this point the turbine has been so perfected that Dresser has to develop a bit which can withstand the great speeds attained by the drill. So the Security Engineering Div's metallurgical labs, heat treating facilities, and testing devices will buckle down to the job of creating a satisfactory turbo-bit.

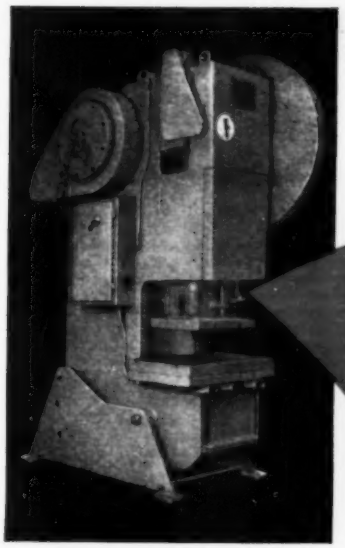
Dura Acquires Buch Manufacturing

Dura Corp, formerly Detroit Harvester Corp, has purchased Buch Manufacturing Co Elizabeth, Penna, maker of wheeled lawn and garden tools. Buch will be operated as a unit of Moto-Mower, Inc, a Dura subsidiary which makes power lawn mowers.

Electric Storage Battery Co...

. . . has purchased the Raleigh, NC, plant of American Machine & Foundry. Facility will continue to turn out silver-zinc batteries for use in guided missiles. AM&F is moving to Richmond, Va, that portion of its Raleigh operations related to the development of tobacco manufacturing equipment.

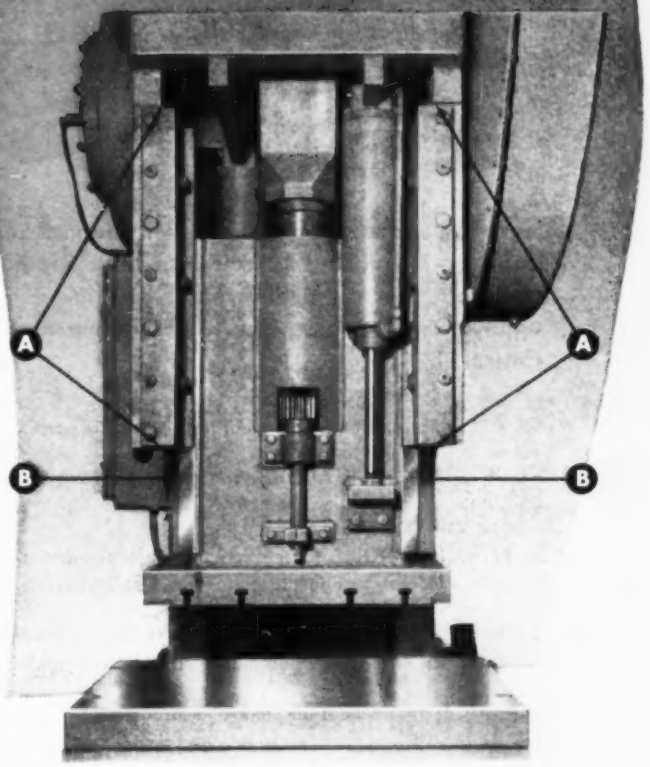
"I must have dozed — when did you stop talking?"



extreme accuracy...
longer die-life

...yours in this Oliver-Farquhar Press

with **boxed type slide construction!**



The boxed type slide construction of the Oliver-Farquhar O. B. I. Mechanical Gap Press gets more dollars from your dies by extending their productive life. And the stability of this slide means high production with maximum accuracy, stroke after stroke.

Guiding surfaces of the slide are placed where they do the most good—one at each of the four corners, away from the center line of motion. The old two-point, V-type guide is just not good enough for your press work. And for fast operation, maximum stability, the guides are extra long—no tendency to bind. Gibs, front and back, are easy to get to, easy to adjust.

The slide is only one of many important advantages built into Oliver-Farquhar O. B. I. Mechanical Gap Presses. Made by one of this country's pioneer press builders, these dependable presses are ready now for delivery in four standard models: 75, 110, 150 and 200-ton capacities.

Write, wire or phone for full details or ask for our recommendations.

Close-up showing the front of the boxed type slide. Arrows (A) indicate two of the four extra long guides. These, with the two matching guides in the back of the press, provide guiding surfaces on the slide (B) at four corners.

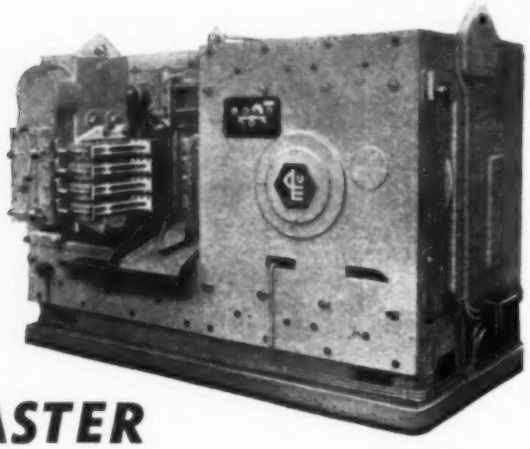
OLIVER *Farquhar* PRESSES

THE OLIVER CORPORATION

A. B. FARQUHAR DIVISION • *Press and Special Machinery Departments* • YORK 16, PA.

COLD FORMING DIFFICULT PARTS . . .

WITH THE



BOLTMASTER

Hexagon Socket Screws, Shafts with Geared Shoulders, Hexagon Head Bolts, Shoulder Screws, Engine Valves and bolts having 5 different diameters are normal applications for these German built cold forming machines.

★ ONE WORK CYCLE—permits completion of very intricate parts

★ PRESSING DIES AT 4 WORK STATIONS—conveniently arranged "get-atable" position

★ WIRE FEED AT RIGHT ANGLES to the forming slide movement—blanks cut off by main slide eliminating separate cut-off mechanism

★ TRANSFER OF PARTS—by simple transport levers or permanent magnets. Whole mechanism can be swung aside making dies readily accessible

★ POSITIVE EJECTION in punches of 2nd and 3rd station—standard equipment

★ 4 MODELS—capacities 3/8", 1/2", 3/4" and 1" bolts

Write or Phone CL 2-7081 for details!

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The BOLTMASTER Co.

Exclusive importers of German Craftsman Peltzer & Ehlers Machinery—builders of machinery for the Bolt Industry since 1888

5305 West 130th St., Cleveland 30, Ohio

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

MACHINES AND ATTACHMENTS

● ACME-GRIDLEY BAR AUTOMATICS—*National Acme Co, 170 East 131st St, Cleveland 8, Ohio.* 44-page catalog MSB-59 illustrates and describes complete line of multiple spindle bar automatics. Discusses engineering design and construction features of all models of 4, 6, and 8-spindle units; pictures many typical standard and special independently operated attachments designed to increase production, finish, and to perform secondary operations. Request direct on company letterhead.

1 THREAD ROLLING AND FORMING MACHINE — *Landis Machine Co, Waynesboro, Penna.* 11-page bulletin E-101 contains information on the Lan-Nu-Rol, particularly suited for automatic thrufeed rolling. Although intended primarily for hand-loaded infeed rolling operations, automatic feeds can be supplied for infeed rolling wherever practical. Design features, specifications and capacities included.

2 PNEUMATIC FORGING HAMMERS —*Williams-White & Co, 700 Third Ave, Moline, Ill.* 4-page folder is a guide to evaluation, use, and operation of Bates type hammers. Data relating the weight of the striking parts to the size of stock to be worked, blows per minute, and the area of the die faces is given. Diagrams show the principle of Bates operation as well as a comparison of its stroke pattern with conventional hammers.

3 GEAR SHAVERS—*National Broach & Machine Co, 5600 St Jean, Detroit 13, Mich.* 16-page bulletin S-54-2 provides illustrated data on Red Ring machines for horizontal shaving of large external gears. Models pictured; operational details discussed; specifications and capacities tabulated.

4 BAR PROCESSING MACHINE — *Loma Machine Mfg Co, 114 East 32nd St, New York 16, NY.* 4-page bulletin 596 gives details on the Lomatic automatic high-speed unit for continuous cold drawing, straightening, cutting, and polishing of bars from coiled rod. Equipment processes rounds, squares, hexagons, and rectagular sections in both ferrous and non-ferrous metals.

5 PORTABLE GRINDING WHEEL BALANCER—*Aero Supply Mfg Co, Corry, Penna.* 4-page illustrated bulletin 2260 describes fast, accurate method of balancing grinding wheels with simple equipment that reportedly offers time savings up to 80%. Includes step-by-step photos showing how the Aero Balancer is used to balance wheels in less than 30 minutes without removing wheel from its machine, with repeated accuracy within 0.000040 in. displacement.

TOOLS AND ACCESSORIES

6 MILLING CUTTERS AND GEAR HOBS—*Hanson-Whitney Co, 169 Bartholomew Ave, Hartford 2, Conn.* 36-page engineering manual, catalog CH-1, covers multiple thread milling cutters and fine pitch gear hobs. Contains informative material on all phases of threading by the multiple thread milling process and the hobbing of fine pitch gears, including advantages, uses, application, sharpening, recommended feeds and speeds, thread generating, and engineering data. Line drawings explain the more technical aspects of the subject.

7 PRECISION BORING, FACING, INTERNAL THREADING TOOLS — *Comet Tool Co, 748 Broadway, New York 3, NY.* 6-page illustrated brochure lists 17 different sizes of these tools for holes from 1/16 in. dia and up. Also describes new solid carbide insert boring tools as well as complete jig boring sets.

8 THERMOCOUPLES, COMPONENTS AND ACCESSORIES — *Leeds & Northrup Co, 4901 Stenton Ave, Philadelphia 44, Penna.* 52-page catalog EN-S2, illustrated, offers complete information on full line. Lists and describes standard assemblies in protecting tubes and wells for general applications; specialized thermocouples and assemblies for lab and industrial applications; and an extensive line of bare and insulated thermocouple wires, replacement elements, ceramic insulators, metal and ceramic protecting tubes, wells, terminal heads, and extension leadwires.

9 NOMOGRAPH FOR CIRCULAR MILLING CUTTERS—*Morse Twist Drill & Machine Co, New Bedford, Mass.* Nomograph for determining performance of cutters is a punched fold-out designed for ringbinder insert. Graphically shows cutting standards for circular milling cutters when applied to various metals and plastics.

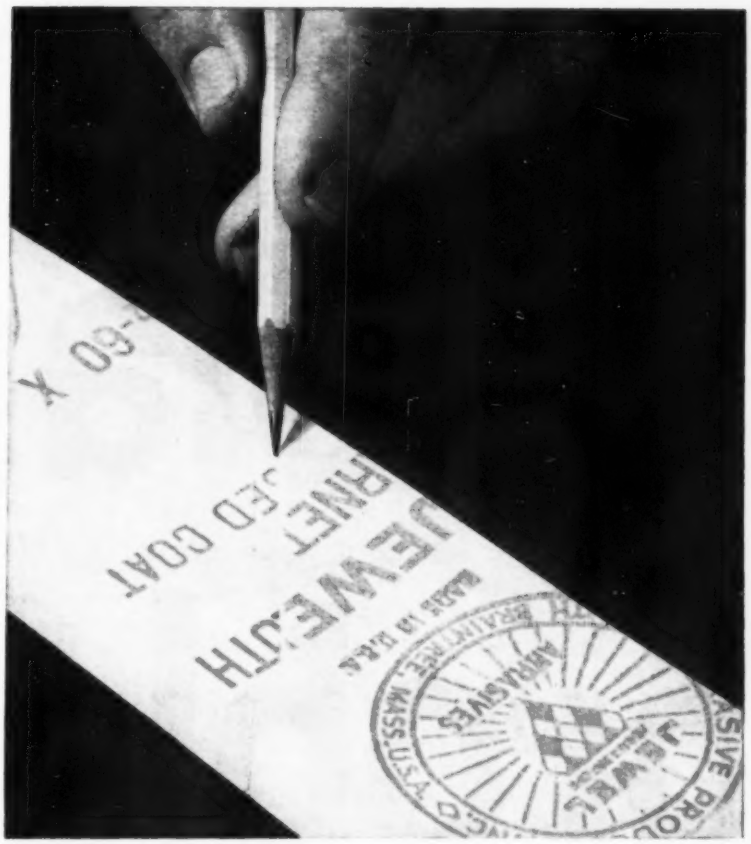
10 CYLINDRICAL GRINDING WHEELS —*Macklin Co, Jackson, Mich.* 4-page illustrated brochure describes the abrasives and bonds employed for various cylindrical cutting operations, and discusses desired characteristics of wheels. Includes wheel test records and recommendations for cutting a wide range of metals.

11 ADJUSTABLE FLANGED TOOLHOLDERS — *Gahr Machine Co, 19199 St Clair Ave, Cleveland 19, Ohio.* Catalog sheet provides information on line for use on turret lathes and hand screw machines. Holders may be adjusted to accommodate misalignment or inaccurate tools and then locked in place. All types of tools can be mounted in the holders.

12 SCANNER—*James Cunningham, Son & Co, 100 Litchfield St, Rochester 8, NY.* Illustrated bulletin 58-217 gives details on self stepping crossbar scanner, Model SC-4, for a wide variety of testing and monitoring operations. Lists standard and optional features available with the unit which incorporates remote dial controlled monitoring. Portable unit can be set up at any given location. Complete driving circuitry and electrical and mechanical specifications included.

(continued on p 226)

The shrink fit that didn't stop shrinking!!!"



How to make both ends meet . . . and still cut finishing costs!

Time was when abrasive belt joints raised a rough problem in finishing circles. The early overlapping joints caused belts to rotate unevenly, chatter and mar freshly finished surfaces. Not so now! Today, Jewel Brand "Velvet Joints" have put the "smooth" back in smoothing operations. Jewel Brand Belt ends are neatly blended to form velvet smooth joints which permit an even flow of cutting surfaces and eliminate jumping. The result is a smooth, uninterrupted action that speeds up grinding, finishing and polishing . . . helps keep product finishing costs in line. A Jewel Brand Engineer will be glad to demonstrate these superior belts in action in your plant without obligation. Arrange for a free demonstration now. Write Abrasive Products, Inc., 561 Pearl Street, South Braintree 85, Massachusetts.

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rolls
sheets
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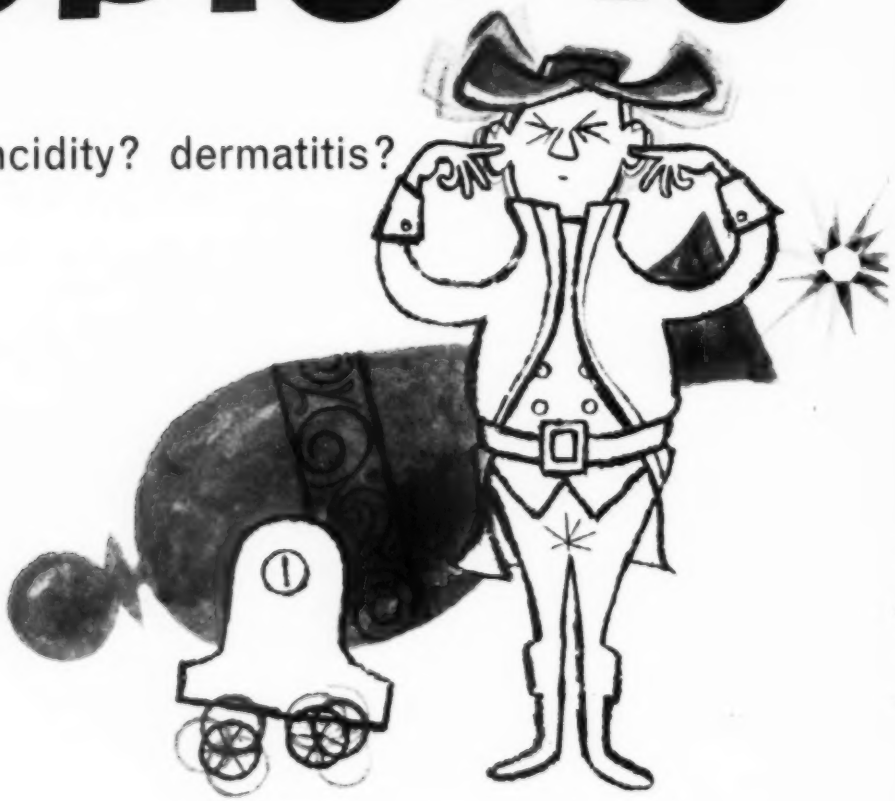
JEWEL BRAND

COATED ABRASIVES

ABRASIVE PRODUCTS, INC., South Braintree 85, Massachusetts

coolant problems

rust? rancidity? dermatitis?



Cold Stream stops rust resists rancidity reduces causes of dermatitis These problems start when your coolant gets dirty. Cold Stream stays clean week after week—even on cast iron. Cold Stream gives longest tool life. Finest finishes. Highest speeds and feeds. Best dimensional control. Cold Stream gives you everything you ever expected in a coolant!

JOHNSON'S

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Stays clean week after week and gives you all the performance you pay for.

JOHNSON'S WAX

For information, see your local Johnson industrial distributor.

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You can't afford it!

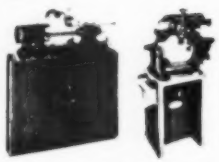
As the pictures show, taps cost roughly 6 times as much as drills. Yet it's common practice to resharpen the drill — and throw away the tap.

It doesn't make sense. And it's an awful waste of money.

That's where Blake comes in.

Blake makes low cost, high-precision tap grinding equipment. These easy operating tools can make your taps last up to 6 times longer . . . reduce work spoilage . . . enable taps to cut more accurately and uniformly with less strain . . . cut tap costs as much as 65%.

It's surprising how many people overlook this proven, basic method of saving money. Be sure you don't. Ask us for complete information.



Blake Chamfer Grinder, Blake Flute Grinder used in combination, create or restore
1. exact indexing of cutting edges.
2. controlled rake angles for each job.
3. correctly ground spiral points.
4. perfectly relieved chamfers . . . make one tap do work of six!

EDWARD **BLAKE** COMPANY, INC., DEPARTMENT 11, 570 PLEASANT STREET, WATERTOWN, MASSACHUSETTS WA 6-0100

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One of these Wilson "Rockwell" instruments will do your hardness testing job

No matter what your hardness testing requirements are, there's a Wilson "Rockwell" tester to do the job. Choose from this complete selection of hardness testing equipment:

"Rockwell" Hardness Tester—for most hardness testing functions.

"Rockwell" Superficial Tester—for extremely shallow indentations.

TwinTester—Combines functions of "Rockwell" and "Rockwell" Superficial testers.

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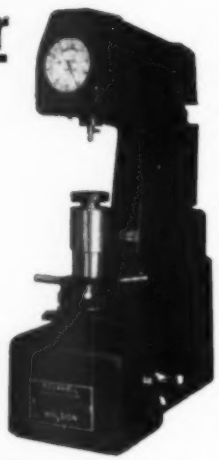
Special Machines—for testing large objects, internal readings, and other unusual applications.

Diamond "Brale" Penetrators—Flawless diamonds, individually calibrated, and highest quality construction assure perfect testing every time.



Write for Bulletin RT-58

WILSON "ROCKWELL" HARDNESS TESTERS

Wilson Mechanical Instrument Division
American Chain & Cable Company, Inc.
230-B Park Avenue, New York 17, New York

ACCO

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

13 AUTOMATIC PARTS COUNTER— *Atronic Products, Inc, One Bala Ave, Bala-Cynwyd, Penna.* Product information bulletin describes Model 605, a fully transistorized electronic unit that counts odd shaped objects at very high speeds and with high accuracy. Device is primarily designed for items that are marketed by count.

14 FASTENER INSTALLATION TOOLS — *Huck Manufacturing Co, 2480 Bellevue Ave, Detroit 7, Mich.* 4-page illustrated bulletin, Form 8-475, describes Model 285 and 287 Pneu-Hydra tools and discusses their operating characteristics. Performance curves show pulling capacity related to input air pressure for each tool. Outline drawings indicate significant external dimensions.

15 RADIAMATIC PYROMETERS — *Minneapolis-Honeywell Regulator Co, Wayne & Windrim Avenues, Philadelphia 44, Penna.* 30-page catalog C93-1a offers complete description of the theory and fundamentals of radiation pyrometry as well as the function, construction, and application of these units. Section included on how to choose the proper radiation detector. Instruments that can be used with this type of temperature sensing element are described in detail.

16 PRESSURE PICKUP—*Consolidated Electrodynamics Corp, 360 Sierra Madre Villa, Pasadena, Calif.* Illustrated bulletin 1620 provides data on new Type 4-326. Capable of absolute and gage measurement to 10,000 psi, unit has a provision for external adjustment of temperature compensation, sensitivity and bridge balance. Design features and specifications, schematic drawing, and a wiring diagram included.

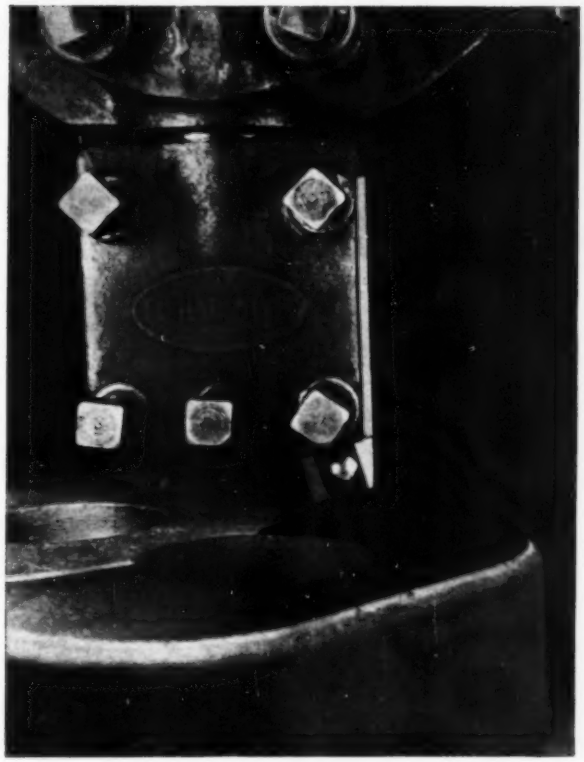
17 MEASURING INSTRUMENTS — *Testing Machines, Inc, 72 Jericho Turnpike, Mineola, NY.* Literature covers special purpose instruments for internal and external measurements of molded pieces, castings, and irregularly shaped parts. Includes data on precision motorized and manually operated dead weight micrometers for accurate measurement of thin sheet materials. Separate sheet illustrates 24 suggested methods of solving difficult and unusual measuring problems.

(continued on p 228)

"Just put out the fire . . . you don't need a requisition for water!"

THEY SPEND MORE pennies

TO MAKE MORE dollars



Without coolant, this Bullard lathe makes a .125 rough cut and .050 finish cut using Kennametal Grade K6 inserts in a Kendex* (patented) holder. Sand holes in the castings add to the difficulty of an interrupted cut. Photos and production data courtesy of American Coleman Company, Littleton, Colorado, manufacturers of trucks, tractors, front drive axles, and related parts.

	50 RPM 24 Minute Tool Life	88 RPM 15½ Minute Tool Life
Feed	.027	.027
Cutting Time:		
First side—rough cut	7 minutes	4½ minutes
First side—finish cut	7 minutes	4½ minutes
Second side—rough cut	5 minutes	3¼ minutes
Second side—finish cut	5 minutes	3¼ minutes
Total cutting time	24 minutes	15½ minutes
Pieces per cutting edge	2	1
Machine cost per hour	$6.00	$6.00
Tool cost per hour	.075	.27
Machine and Tool cost/8 hours	$48.60	$50.16
Pieces finished per 8 hours	5	9
Cost per piece	$9.72	$5.57

KENNAMETAL*
tooling permits 75% SFM increase... cuts cost per piece almost in half

Like many others, this plant is sacrificing pennies in tool costs to make dollars in production profits. At 50 rpm, this boring mill faced cast iron housings at a maximum speed of 289 sfm. Each Kennametal cutting edge faced both sides of two pieces with production averaging 5 pieces per 8-hour shift. When the maximum speed was increased to 510 sfm, the cutting insert had to be changed for each piece.

This reduction in machining time, plus some additional time saved by an improved method of holding the workpiece, enabled production to increase to 9 pieces per shift.

Sacrificing a few pennies of increased tool costs to make dollars in production profits is not a new idea. It has been proven-in-use by many progressive plants, and we will gladly send you records of such operations. These results can be duplicated in other plants where machines and talented operators have been held back by old ideas about tooling and tooling costs.

Ask your Kennametal Carbide Engineer how Kendex* (patented) tooling can help you get more efficient output from *your* machines . . . or write direct for the booklet, "There's Profit in Retiring a Tradition." KENNAMETAL INC., Latrobe, Pennsylvania. 97237

*Trademark

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CIRCLE 323 READER SERVICE CARD

Announcing ...a fully-automatic precision DRILL POINTER

the

Model 100 WINSLO-MATIC DRILL POINTER

See the **WINSLO-MATIC DRILL POINTER** in operation at the National Metal Show in Chicago – Booth 1362

THE ONLY DRILL POINT GRINDING MACHINE WITH ALL OF THESE OUTSTANDING FEATURES AND ADVANTAGES

- **FULLY-AUTOMATIC CYCLE – INCLUDING EJECTION OF DRILLS**
- **WILL GENERATE HELICAL OR CONVENTIONAL POINTS**
- **DRILL POINTS CONCENTRIC WITHIN .0002**
- **HIGH PRODUCTION RATE – CYCLES IN 3 SECONDS**
- **PACESETTER ADJUSTER SETS INTERVAL BETWEEN CYCLES**
- **LOCATES ON THE POINT – NO ADJUSTMENTS REQUIRED FOR VARIATIONS IN DRILL LENGTHS**
- **FULLY AUTOMATIC SELF-COMPENSATING WHEEL DRESSER**

Here is one of the most sensational machines ever to be introduced to industry! The Model 100 WINSLO-MATIC DRILL POINTER produces *automatically and with extreme precision*, the Winslow Type 4 drill points or other helical (self-centering) points, as well as conventional points. And in addition, the drill point on most drill countersinks can be sharpened with this machine.

Forms are generated by means of a combination of 2 cam movements. The drill point angle is formed on a 20" diameter grinding wheel. The number of drills pointed between automatic dressings is pre-determined by a selector switch. The WINSLO-MATIC DRILL POINTER operates on a single source of power (electrical). Grinding wheel and work-head are well guarded to retain coolant and spray, assuring a clean, anti-splash operation. Unit occupies only 36" x 48" floor space. Work-head is at convenient level for maximum ease of operation.

No other machine can match the precision, production and labor-saving advantages of the revolutionary WINSLO-MATIC DRILL POINTER. Write for full details today!

WRITE TODAY

...for WINSLO-MATIC DRILL POINTER Bulletin and name of your nearest dealer.

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Manufacturers of power hand tools and accessories for the nation's aircraft and manufacturing plants.

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NUTPLATE DRILL MOTOR A portable power tool used on Nutplate installations.

SPACEMITE DRILL MOTOR A heavy-duty tool that replaces angle drills for limited-access-area drilling.

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

HEAT TREATING AND WELDING

18 INDUCTION HEATING EQUIPMENT—*Induction Heating Corp, 181 Wythe Ave, Brooklyn 11, NY.* 52-page catalog-handbook covers most recent developments in hardening, brazing, soldering, forging, and annealing by Ther-Monic equipment. Applications illustrated, case histories discussed.

19 AUTOMATIC HEAT TREATING UNITS—*Ipsen Industries, Inc, 721 S Main St, Rockford, Ill.* 6-page bulletin T-19-C contains cross-section drawings, photos, and tabular data on construction and performance of equipment which operates at temperatures up to 2000 F. Units are designed for carburizing, carbon restoration, carbonitriding, neutral hardening, marquenching, normalizing, annealing, and brazing.

20 HEAT TREATMENT OF TOOL STEELS—*Uddeholm Co of America, Inc, 155 East 44th St, New York, NY.* 28-page technical booklet describes derivation and meaning of the TTT diagram and provides fundamental information on various heat treating procedures including step-annealing, martempering, and austempering. Also includes TTT diagrams for all commonly used grades of SAE tool steels and is illustrated with photomicrographs and charts to clarify text.

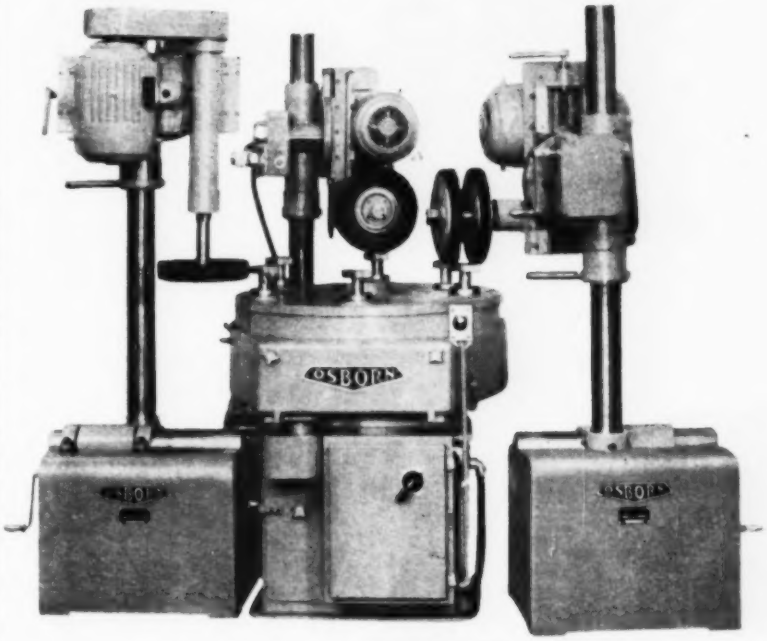
21 PRESSURE NITRIDING PROCESS —*A F Holden Co, 14541 Schaefer Highway, Detroit 27, Mich.* 18-page engineering bulletin 204 describes a recently developed liquid pressure process reported to be an economical method for producing an extremely hard case on nitrided steel parts to make them resistant to spalling and softening at high temperatures. Graphs included show relationships of case depths and hardness vs time in the salt bath furnace, and data for controlling decarburization in nitriding baths.

22 HARD-FACING ALLOY—*Wall Colmonoy Corp, 19345 John R St, Detroit 8.* Illustrated engineering data sheet 57 describes new Colmonoy C-290 crankshaft

"I'd be happy to promote you, Binks, but contrary to the old saying, there's no more room at the top."

Cut your metal finishing costs with this...

NEW OSBORN BRUSHAMATIC® ROTARY INDEX MACHINE



NEW OSBORN BRUSHAMATIC® ROTARY INDEX MACHINE
Units can range from manual to fully automatic operation.

Unique "building block" design means unlimited production flexibility

NEWEST ADDITION to Osborn's broad line of metal finishing machines are these Brushamatic® Rotary Index units. Capability: significant increase of your production capacity.

Most important feature—production men can economically "build" *custom* Brushamatic Machines from *basic "building block"* components . . . brushing heads, index tables and electric controls. Other advanced design and construction features make these new Brushamatic units worth your immediate investigation.

Your Osborn field specialist has latest application data on a wide range of cost-saving finishing methods. And an **O**sborn **B**rushing **A**nalysis—made in your plant—is the first step to pinpoint savings on *your* operations. Write for details. *The Osborn Manufacturing Company, Dept. C-90, Cleveland 14, Ohio.*

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POWER, PAINT AND MAINTENANCE BRUSHES
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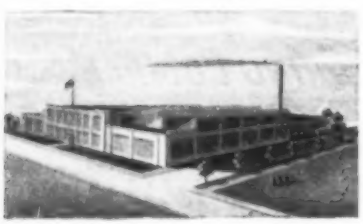

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metalspray powder. Discusses physical properties and characteristics of the material, illustrates some of the steps in its application. Complete step-by-step application procedure is included.

PLANT SERVICE EQUIPMENT

23 METAL CLEANING—*Oakite Products, Inc, 124 Rector St, New York 6, NY.* 28-page illustrated handbook discusses chemistry and techniques of cleaning; tank cleaning, with suggestions for tank design and layout, and selection of detergents; electrocleaning; barrel cleaning; machine cleaning; and ultrasonic cleaning. Discusses relative advantages of iron and zinc Oakite CrysCoat phosphating processes and ChromiCoat aluminum conversion as prepaint treatments. Covers pickling, deoxidizing, and metal etching treatments; rust prevention; paint stripping; and paint spray booth water curtain additives.

24 METAL SURFACE PROCESSING—*Ransohoff Co, Hamilton, Ohio.* 40-page catalog covers machinery and machinery systems for cleaning, washing, rinsing, drying, spraying, flow and dip coating. Illustrates and describes drum-type machines, conveyor machines and systems, combination drum and conveyors units, monorail machines, Ransomatics, and complete automatic finishing systems. Components and accessories listed.

• POWER DRIVE CALCULATOR — *Atlas Chain & Manufacturing Co, Dept C, West Pittston, Penna.* Calculator slide rule for computing the proper roller chain for every type of drive supplies user with all necessary technical data for selection of roller chain and sprockets. Covers all factors in step-by-step form. Each step relative to the application of the right drive is done with a combination of six slide rules made into one large calculator. Request direct on company letterhead.

25 FORK LIFT TRUCKS — *Allis-Chalmers Manufacturing Co, Engine-Material Handling Div, Milwaukee, Wis.* 16-page illustrated booklet covers the FT Series. Describes engineering, design, construction, and operating features.

26 STEEL STRAPPING EQUIPMENT —*Signode Steel Strapping Co, 2600 North Western Ave, Chicago 47, Ill.* 4-page illustrated folder SPD-216 illustrates and provides information on complete line of air power tensioners and sealers. Applications pictured.

27 ELECTRIC - POWERED MOBILE CRANES — *Elwell-Parker Electric Co, 4205 St Clair Ave, Cleveland 3, Ohio.* 6-page folder gives details on complete line with capacities from 3000 to 10,000 lbs. Each section, covering a specific model, contains illustrations, engineering drawings, specifications, turning radius, design and operating data. Applications pictured in on-the-job photos.

28 HEAVY - DUTY FORK LIFT TRUCKS — *Gerlinger Carrier Co, Dallas, Ore.* Illustrated booklet GSP-1 presents construction, operating, and engineering details on line of 27 models with capacities from 8000 to 40,000 lbs. Components pictured and described.

PARTS AND MATERIALS

29 ELECTROMAGNETIC CLUTCHES —*I-T-E Circuit Breaker Co, 1900 Hamilton St, Philadelphia 30, Penna.* 20-page bulletin R-6304-1B contains detailed

information on line in six series with torque capacities from 1.8 through 13,000 lb-ft. Clutches provide instantaneous push-button or automatic programming control of shaft-driven machinery in a variety of fields. Provides general information on design advantages, clutch selection for a specific application, operating characteristics; includes dimensions, torque ratings, speeds, prices, accessories and components.

● MEEHANITE CASTINGS — *Meehanite Metal Corp, 714 North Ave, New Rochelle, NY.* 20-page illustrated booklet, "Proof That Meehanite Bridges the Gap," includes alphabetical tabulations showing specific replacements of alloyed irons, steels, brass, bronze, as well as type of Meehanite metal used in such applications. Request direct on company letterhead.

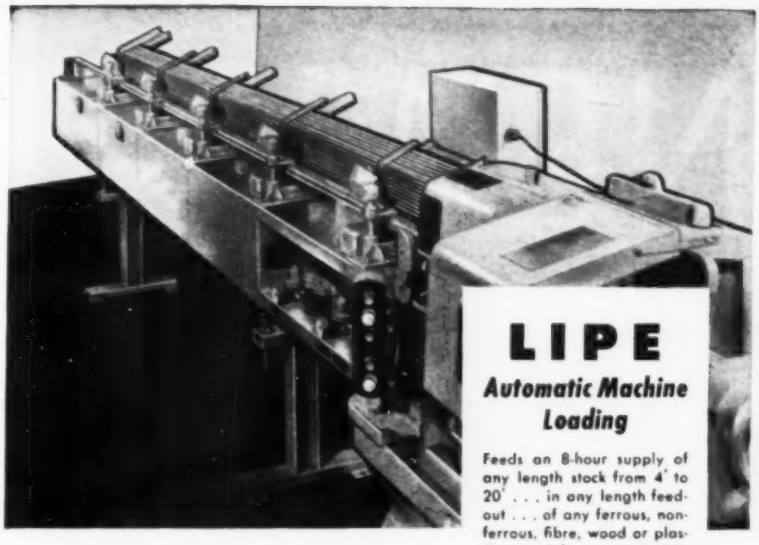
30 MAGNETIC STARTERS — *Furnas Electric Co, 1044 McKee St, Batavia, Ill.* 16-page catalog 14-B1 gives data on redesigned line of starters through 15 hp 440-550 v. Features include: all components front removable; dual voltage coils reconnectable on the job; trip-free thermal overload relays with trip indicator.

● RECTANGULAR AND SQUARE BARS—*Titan Metal Manufacturing Co, Cerro de Pasco Corp, Bellefonte, Penna.* 8-page folder gives complete sizes, pounds per foot, and alloy specifications for brass, bronze, and nickel-silver rectangular and square bars. Commercial alloys covered include free-cutting brasses, architectural bronze, forging brass, Muntz metal, cartridge brass, Naval brasses, manganese bronzes, nickel-silver, and commercial bronze. Request direct on company letterhead.

31 RETAINING RINGS—*Ramsey Corp, Retaining Ring Division, 5693 Forest Park Blvd, St Louis 8, Mo.* 40-page engineering specification manual, said to cover 80% of the known applications, combines the Spirolox and improved Circolox ring specifications into one book. Contains application illustrations, data on selection of materials and finishes, design factors, charts on rotative speeds and thrust loads, and typical layouts for both internal and external ring applications.

32 METAL FORGINGS — *Bridgeport Brass Co, Cored Forging Div, South Norwalk, Conn.* 12-page handbook discusses the differences in cost and processing

"Why no, Mr Smathers, I don't have an excuse —unless you call inheriting half-a-million dollars and buying out the company some sort of excuse!"



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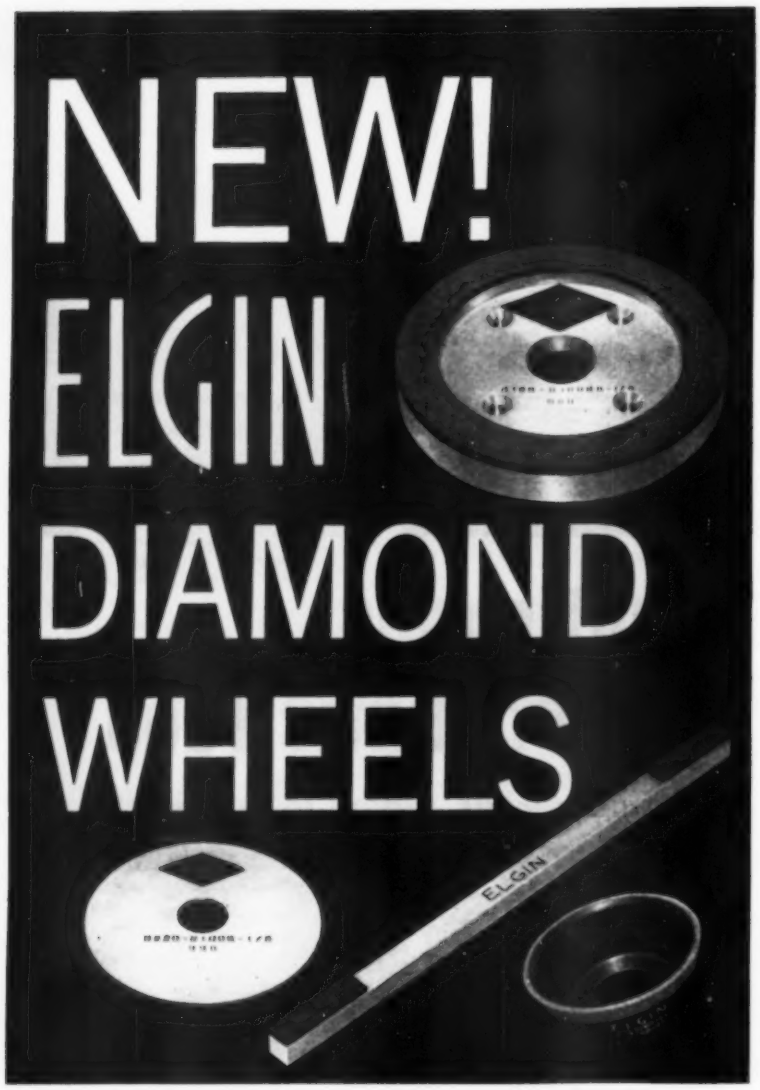
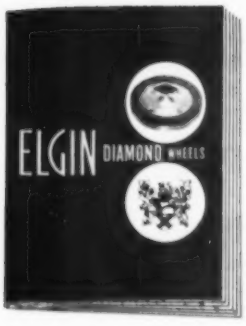
PIONEERS IN PNEUMATIC BAR-FEEDING





Now – ELGIN offers you a complete line of Golden Circle Diamond Wheels with *guaranteed diamond content*

Diamond wheels—every shape, every size—resinoid, metal, or vitrified bonded—they're all available from Elgin! Guaranteed diamond content means more pieces ground per wheel, more return on your wheel-dollar. Consult an Elgin field engineer—his broad abrasives experience will help you select the right grit, wheel-shape, and bond—the wheel that will keep your grinding costs down. Our new diamond wheel catalog greatly simplifies ordering. Write for it today.

Abrasives Division
ELGIN NATIONAL WATCH COMPANY
ELGIN, ILLINOIS

Free Literature

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between castings, complicated machined part assemblies, solid forgings, and cored forgings.

33 WELDED METAL BELLOWS DESIGN MANUAL—*Belfab Corp, 905 Hobson Ave, Hamden, Conn.* Manual (with accompanying slide rule) contains advanced mathematical formulas for computing reasonable design parameters for welded metal bellows for use as volumetric expansion devices, pressure sensors, rotary and linear seals, aneroids, stem seals, expansion joints.

34 CORROSION CHART FOR RARE AND REACTIVE METALS—*Damascus Tube Co. Greenville, Penna.* Wall chart provides comparative corrosion resistance of zirconium, titanium, tantalum, Hastelloy C, and Stainless 316 tubing to 43 commonly encountered reagents. Materials are shown with ratings from "excellent" (less than 3 mils per year) to "not recommended" (over 50 mils per yr) for various concentrations and temperatures.

35 ELECTRIC MOTORS AND GENERATORS—*Imperial Electric Co, 81 Ira Ave, Akron 9, Ohio.* 6-page bulletin covers ac and dc products including squirrel-cage ac motors, special purpose motors, wound-rotor motors, dc motors, generators and motor-generator sets. All lines are illustrated. Range of motors covered is from 1 to 200 hp; motor-generator sets from ½ to 150 kw.

36 SERVO COMPONENTS—*Vernitron Corp, 156 Church St, New York 7, NY.* Illustrated brochure contains specifications on company's control and torque synchros and resolvers.

37 AIR CONTROL VALVES—*Cleveland Pneumatic Industries, 64 Old Orchard, Skokie, Ill.* Two new bulletins describe a complete line of hand, foot, air, and solenoid-actuated units. Bulletin 8100 illustrates and provides data on disk-type valves from ¼ through 1-in. pipe sizes, and a complete line of pilot-operated valves from ¼ through ¾-in. pipe sizes. Most models are available for 2, 3, or 4-way operation. Bulletin 8101 covers the Designer Series of ⅛ through ½-in. valves recommended for direct actuation of small cylinders and for use as pilot valves in sequence circuits. This line is available with a wide variety of actuating heads.

38 TUBE AND BAR STOCK—*Shenango Furnace Co, Centrifugally Cast Products Division, Dover, Ohio.* 6-page bulletin 156 offers detailed information on stock available in three special materials—GC Meehanite Metal, GA Meehanite Metal, and Type No. 1 Ni-Resist. Applications illustrated; physical properties chart serves as application guide.

39 FLEXIBLE COUPLINGS — *Chain Belt Co, Milwaukee 1, Wis.* Revised bulletin 597 on Rex roller chain couplings discusses advantages such as all-steel construction, accommodation of angular and parallel misalignments with minimum backlash, easy installation or removal. Includes selection data, illustrates installation and maintenance procedures.

40 DIRECTIONAL CONTROL VALVES—*Sarasota Precision Products, 1313 N Lime Ave, Sarasota, Fla.* Nine engineering data sheets provide information on 94 different models of Spherotor 5000 Series 2 and 4-way units for use at 0-3000 psi working pressure with hydraulic oils, non-corrosive fluids, and lubricated air. Includes schematic drawing, typical cir-

cuit applications, flow characteristics, approved JIC symbols, and dimensions.

41 EPOCAST LAMINATING RESIN—*Furane Plastics Inc, 4516 Brazil St. Los Angeles 39, Calif.* 4-page illustrated bulletin outlines major uses of epoxy resins in aircraft, automotive, missile, structural, model-making, and maintenance fields. Table of properties reports complete physicals, not only on the laminated structures, but also on the resin itself. Basic data on epoxy laminates included.

MISCELLANEOUS

42 MATERIALS EVALUATION FACILITIES AND SERVICES—*United States Testing Co, 1415 Park Ave, Hoboken, NJ.* 6-page bulletin 5902 describes company's facilities and services for analysis, development, research, and inspection of materials and products. Among services offered are metallurgical studies, metals chemistry, plastics evaluation, and physical testing. Tests and studies handled in the laboratory include defect analysis, legal investigations, photomicroscopy, chemical analysis, physical and mechanical properties at sub and supra-normal temperatures.

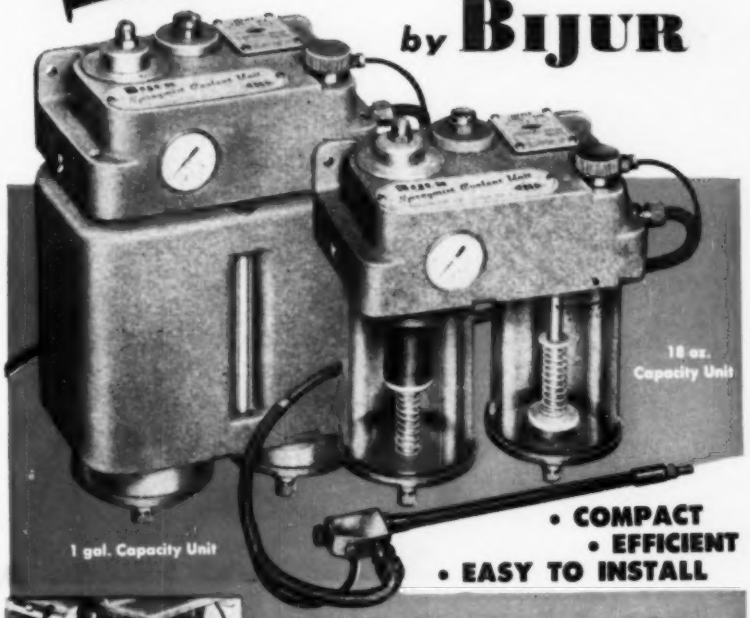
43 CHEMICAL AND METALLURGICAL TESTING SERVICE—*Frank L Crobaugh Co, 3800 Perkins Ave, Cleveland 14, Ohio.* Brochure details complete testing facilities. Illustrated and described is equipment for organic and inorganic chemical analysis; metallurgical physical testing; metallography; spectographic analysis; corrosion testing; radiography inspection of castings and weldments. Special section describes use of Cobalt 60 and Iridium 192 for radiography of castings when regular X-ray is no longer feasible.

44 MANUFACTURING FACILITIES—*General Machine Products Co, Old Lincoln Highway at Pennsylvania Turnpike, Trevose, Penna.* Brochure describes facilities for manufacture of special machinery, tools, communications equipment, controls, aircraft components and subassemblies, electrical and electronic equipment and subassemblies, and precision parts of all types and sizes. Design and engineering services offered for special machinery, tools and components.

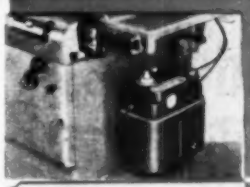
"Remember kid, never make the mistake that you're as smart as Fred, and you won't be for another 5 or 10 days."

NOW... ENGINEERED MIST COOLANT EQUIPMENT!

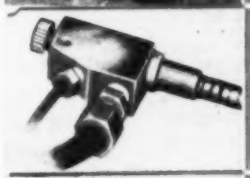
Spraymist* by BIJUR



• COMPACT
• EFFICIENT
• EASY TO INSTALL



Compact Integral Unit Design includes built-in air filter, trap, regulator, gauge, solenoid valve, conduit box, pressurized reservoir, and coolant filter. No unsightly plumbing, extra valves or controls!



Individual Jet Control. Precision needle-valve control permits a range of settings from superfine mist to heavy spray. Unique Spraymist design forms the mist *in the jet tip*, not the tube. There's no flooding, sputtering or condensate drip! One Spraymist unit can supply up to 10 or more jets by branching from existing lines.

Automatic Operation saves time and trouble. Solenoid valve, connected to machine circuit, starts Spraymist when machine is turned on. Pressurized reservoir, built-in regulator insures positive air supply, and save shop air. No need for manual air valves!

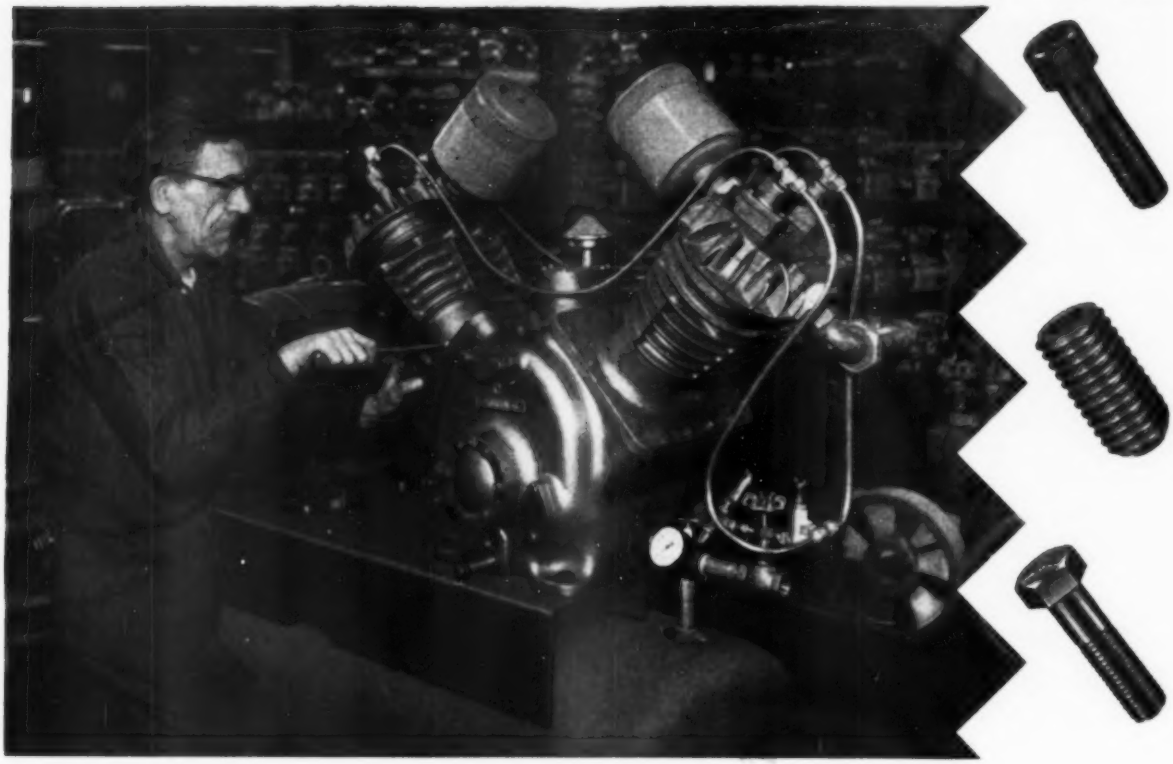
Extremely Adaptable. Use Spraymist on toolroom and production machines. Standardized components make installation and maintenance easy. Choose from 2 reservoir capacities, 3 solenoid ratings, 3 types of jets. Full assortment of hose assemblies and T-blocks for branching. Replaceable jet tips are inexpensive, install in seconds.

SPRAYMIST . . . The modern, compact way to get all the advantages of mist cooling.

Write today for Bulletin.

A Product of **BIJUR** LUBRICATING CORPORATION
Rochelle Park, New Jersey

IT PAYS TO STANDARDIZE ON STANSCREW



Stanscrew provides faster service, adds safety for BRUNNER compressors

The fasteners this man is tightening must be really dependable. Dunham-Bush, therefore, maximizes the safety margin for its Brunner line by standardizing on Stanscrew heat-treated cap screws for all critical applications.

With tremendous production demands on its Hartford plant due to industry's preference for Brunner compressors, Dunham-Bush also demands a supplier who provides quick assistance on all occasions, and moves especially fast in emergencies. Stanscrew meets these requirements because complete stocks are maintained at three conveniently located plants . . . plus a management philosophy which looks on shipments within 24 hours as normal procedure, subject to drastic improvement in emergencies.

Fast delivery and reliable products are but two of many reasons more and more industrial leaders are switching to Stanscrew. A complete selection of over 5,000 different standard fasteners . . . experienced fastener specialists to provide qualified technical assistance . . . these and many other factors underline the advantages of specifying Stanscrew for your fastener requirements.

Why not call your Stanscrew distributor today. He will gladly arrange a prompt visit from the Stanscrew specialist who can often save you money . . . for example, by substituting a standard fastener for a costly special.

STANSCREW FASTENERS

CHICAGO | THE CHICAGO SCREW COMPANY, BELLWOOD, ILLINOIS
HMS | HARTFORD MACHINE SCREW COMPANY, HARTFORD, CONNECTICUT
WESTERN | THE WESTERN AUTOMATIC MACHINE SCREW COMPANY, ELYRIA, OHIO

STANDARD SCREW COMPANY 2701 Washington Boulevard, Bellwood, Illinois

Timken Roller Bearing Co, Canton, Ohio, has announced the retirement of **Wm E Umstattd** (left) as president of the company. He will continue to serve as a director and as chairman of the executive committee. **D A Bessmer** (center), executive vice president, has been elected president to succeed Mr Umstattd. **H E Markley,** vice president, takes over Mr Bessmer's former post.

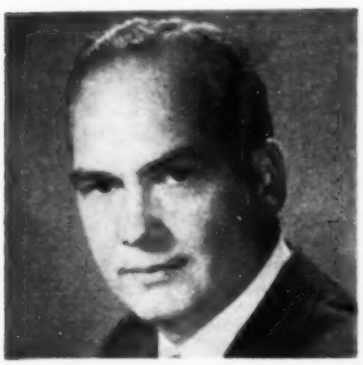
NAMES IN THE NEWS...

General Motors Corp, Detroit, has named **Louis C Goad** executive vice president with jurisdiction over all general staff activities. He had been executive vice president in charge of the auto, body assembly, and parts divisions. **Sherrod E Skinner,** vice president, accessory group, takes over Mr Goad's former post and title. **Cyrus R Osborn,** vice president of the engine group, has been made executive vice president of engine divisions, the Dayton, household appliance, and the electromotive groups, and overseas and Canadian groups. **Roger M Kyes** becomes vice president, accessory group.

Pressed Metal Institute, Cleveland, has named **Federico Strasser** winner of the 1959 Presteel Award. Presented at PMI's annual meeting held at Estes Park, Colo, the award recognizes annually a substantial contribution to enlarging the field of metal stampings, and is sponsored by the **Worcester Pressed Steel Co,** Worcester, Mass.

Lear, Inc, Santa Monica, Calif, has elected **Albert G Handschumacher** president of the company following the resignation of **James L Anast.** Mr Handschumacher was a senior vice president of Lear until 1957 when he became a vice president of Rheem Manufacturing Co. Since 1957 he has served on Lear's board of directors and as a member of its executive committee.

US Chemical Milling Corp has named **Roy B Williams** west coast plant manager for its American Machine Division at Culver City, Calif. He was previously assistant to the vice president of manufacturing at American Bosch Arma Corp.

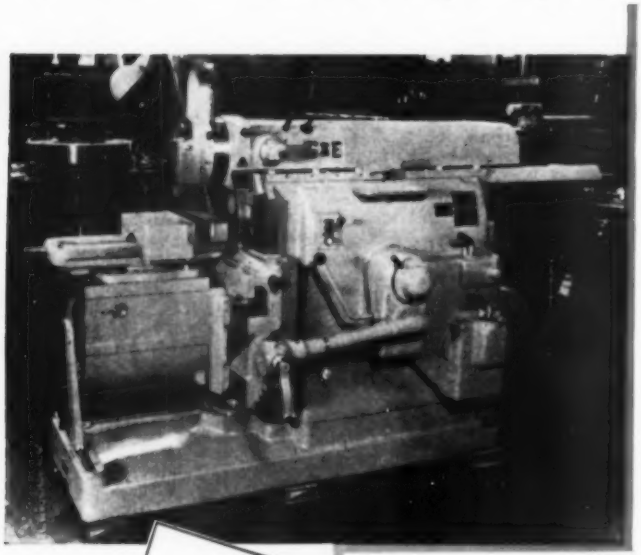


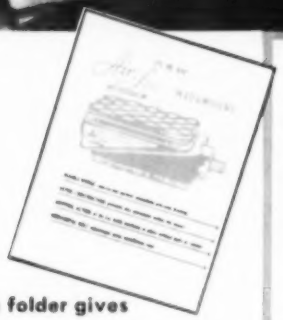
Sheffield Corp, Dayton, Ohio, has named **C Thorpe Thompson** (left), formerly president of the Cleveland Instrument Co, a director, vice president, and general manager of the company. **W Fay Aller,** associated with Sheffield for more than 25 years, has been appointed a director, and vice president, engineering.

Micromatic Hone Corp, Detroit, has named **William J Pinkerton** to the post of executive vice president and assistant general manager. Mr Pinkerton has been administrative vice president since November 1957

Can You Hold Your Shaper Without Bolts?

YES- with new **WEDGMOUNT** which anchors Shapers, Presses, etc. *and* permits precision leveling!





Free folder gives complete facts about

WEDGMOUNT with—

- "Air-Loc" patented vinyl, sisal and cork pads tap and bottom grip machines to floors
- double-wedge construction which permits immediate precision leveling
- keyed construction which prevents movement *within* the mount
- sizes available thru distributors, and prices

This Gould & Eberhardt 24" Industrial Universal Shaper, operating at 120 cuts per minute with a 4" stroke, is installed without bolts on a new type machinery mount called WEDGMOUNT. A dial indicator at the base of the shaper showed a total oscillation of only .022" during operation, and no "walking." The 7,800 lb. machine is installed on six WEDGMOUNTS, each type 3" x 6" S. Before operation, precision leveling is achieved by simple adjustment of a bolt within each mount. Top and bottom of each mount is surfaced with patented "Air-Loc" pads, which provide the high degree of friction required to hold the machine in place despite its strong lateral thrust.

Air-Loc WEDGMOUNT

write to... **Clark-Cutler-McDermott Co.**

West Central Street • Franklin • Massachusetts

NAMES IN THE NEWS...

Lindberg Engineering Co, Chicago, has appointed **Leon C Koenig** vice president, manufacturing. Mr Koenig, a company founder, has been assistant secretary and plant manager

Van Norman Machine Co, Springfield, Mass, has named **George P Burns** sales manager, machine tools. Mr Burns has been associated with development and design of the company's centerless grinders and crush dressing techniques

Eutectic Welding Alloys Corp, New York, has announced the appointment of **Robert F Fox** to the post of national sales manager. He has been serving as regional manager for the metropolitan New York-New Jersey area.

Hyster Co, Portland, Ore, has promoted **Robert F Moody** from sales manager of the industrial truck division to general sales manager of the company.

Kaydon Enginering Corp, Muskegon, Mich, has named **Frank X Bujold** general manager of the Frauenthal Division. He was formerly associated with Ford Motor Co as manufacturing manager of foundries of the Engine and Foundries Division.

(continued on p 239)

5 Positive ways Asarcon® continuous-cast bearing bronze saves you money: 1) Exact lengths. Order Asarcon 773 (SAE 660) in exact lengths you need, up to 105″. No short-end scrap as from ordinary cast bars. 2) Close-to-size. Asarcon 773, in diameters from 1/2″ to 9″, gives you only 1/32″ to 3/32″ to machine off. 3) Less machining. Less stock to remove saves machining time and cost. 4) No blow-holes, pits, or shrinks. No sand to dull tools. No hard or soft spots. No loss of machining time or parts thrown away because of metal defects. 5) Less down-time. The better, more uniform properties of Asarcon 773 assure longer life of important machine parts, and fewer breakdowns. Asarcon 773 bearing bronze is immediately available from stock in 260 sizes, rods, and tubes. Special shapes can be made to order. Write Continuous-Cast Products Department, American Smelting and Refining Company, Barber, N. J. West Coast Distributor: Kingwell Bros., Ltd., 457 Minna St., San Francisco. In Canada: Federated Metals Canada, Ltd., Montreal and Toronto.

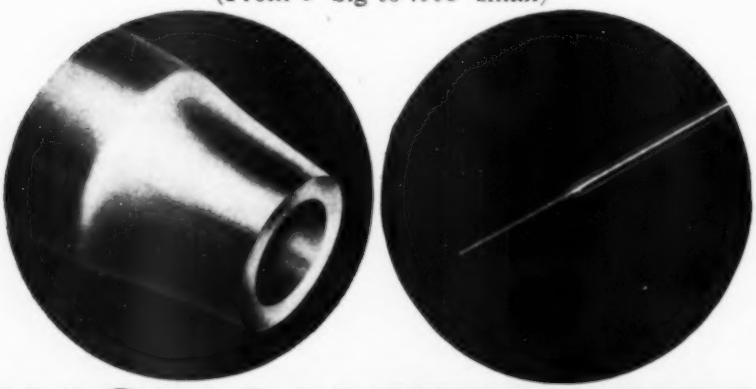
CONTINUOUS-CAST DEPARTMENT OF

ASARCO

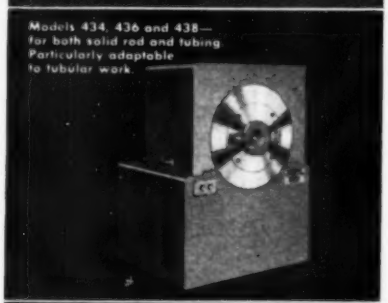
AMERICAN SMELTING AND REFINING COMPANY

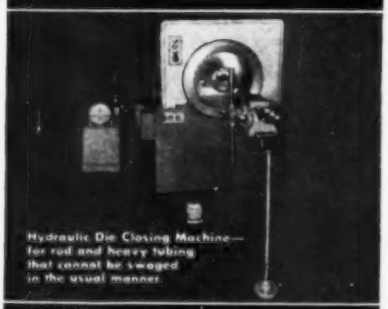
BIG...OR SMALL

(From 6" big to .008" small)



TORRINGTON ROTARY SWAGING MACHINES WILL DO THE JOB





Pointing, tapering, reducing or bonding metal parts? You can do the job faster at lower cost with Torrington Rotary Swaging Machines. The metal is shaped by hammering between dies. No stock is wasted. You get a full pound of parts from every pound of metal. You save time, metal and labor.

And you profit from the unparalleled engineering assistance Torrington provides. As the originator of the swaging process and the largest user of swaging equipment in the world, we can place at your service more swaging experience than any other company. Our experimental shops are available for working out your special problems. If you have a part that can be swaged we have the knowledge and skill to produce the dies to swage it. Bring your swaging problems to Torrington—we can provide the solutions. The Torrington Company, Swaging Machine Division, 200 North Street, Torrington, Conn.

TORRINGTON ROTARY SWAGING

SWAGING HEADQUARTERS, U. S. A.

NAMES IN THE NEWS...

Loewy-Hydropress Division of Baldwin-Lima-Hamilton Corp, New York, has appointed **William L Govan** product sales manager for hydraulic machinery. He will continue to serve as chief project engineer

Greenfield Tap & Die, Greenfield, Mass, has announced appointment of **A F Miller Jr** to the newly created post of sales manager, threading tools and gages

American Die Casting Institute, New York, named its officers for 1960 at its annual meeting held at the Edgewater Beach Hotel in Chicago. **Gordon C Curry,** vice president, Dollin Corp, Irvington, NJ, has been elected president; **Walter E Brown,** executive vice president, Kiowa Corp, Marshalltown, Iowa, is new ADCI vice president.

Varian Associates, Palo Alto, Calif, has elected **Dr Edward L Ginzton** chairman of the board to fill the vacancy left by the recent death of **Dr Russell H Varian.** Dr Ginzton was one of the founders of the electronics firm, and for the past several years served as assistant to Dr Varian.

Now

AUTOMATIC POSITIONING

with the

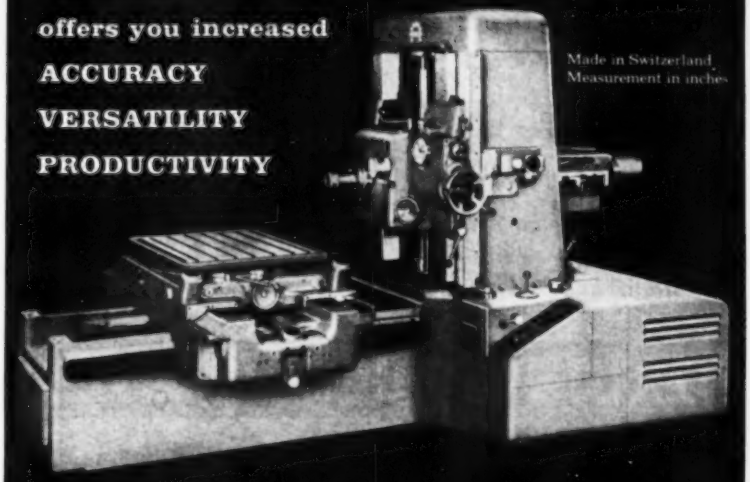
DIXI 75 horizontal optical jig borer

offers you increased

ACCURACY

VERSATILITY

PRODUCTIVITY



Made in Switzerland
Measurement in inches

- Automatic positioning can be changed instantly to manual operation
- Projected optical setting — direct reading to .00005" for linear motions and 1 sec. of arc for built-in rotary table. Linear optics provided with adjustable zero reference
- Simplified controls functionally arranged for greater operating speed and efficiency
- 3" diameter boring spindle
- Increased capacity: table size 39⅜" x 32"; 29½" cross travel; 23⅝" longitudinal travel; 25⅝" vertical travel
- Hydraulic feeds and infinitely variable spindle speeds
- Rear support optional

MBI has engineers available for consultation, guarantees service by factory trained staff, and stocks spare parts in New York.—Join the long list of leading aircraft and manufacturing plants throughout the United States which are using the horizontal optical jig borer.

Demonstrations upon request at our conveniently located demonstration centers.

MBI

M. B. I. EXPORT & IMPORT LTD.

A DIVISION OF MACHINERY BUILDERS, INC.
475 Grand Concourse, Bronx 51, N. Y.
"Over 25 years' experience in designing and building machinery."

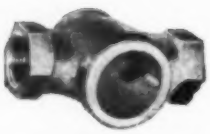
GOSS & DeLEEUW

AUTOMATIC CHUCKING MACHINES

perform one to three operations in sequence or simultaneously . . .

TO CUT PRODUCTION COSTS...

More completely finished parts at the end of the day with no partly finished pieces lying around is the regular accomplishment of Goss & DeLeeuw "1-2-3" chuckers. It means complete finishing on one, two or three ends simultaneously or in sequence without tool resetting, rechucking or parts handling. Machining operations may include boring, facing, turning and threading.



Change over from job to job is simple. Cost-cutting is assured on long or short runs. Goss and DeLeeuw Chucking Machines are the only standard machines of their type which operate the "1-2-3" way to reduce costs per piece and step up the number of pieces per hour.

●

Investigate the opportunities offered by these machines on your production by sending samples of your work for time and cost estimates—Ask for illustrated descriptive literature.

GOSS & DeLEEUW

GOSS *and* DE LEEUW

MACHINE COMPANY, *KENSINGTON, CONN., U.S.A.*

NEW BOOKS...

RISK AND TECHNOLOGICAL INNOVATION: AMERICAN MANUFACTURING METHODS DURING THE NINETEENTH CENTURY — *By W Paul Strassmann. Published by Cornell University Press, Ithaca, NY. 249 pages, 6 x 9 in. Price $4.*

Between 1800 and 1900 the Industrial Revolution successfully conquered the United States, forming the mold from which modern industry has been created. How did 19th Century business enterprise react to these technological innovations? How much risk was involved? Was American industry cautious or daring in its commitments to new methods of manufacturing?

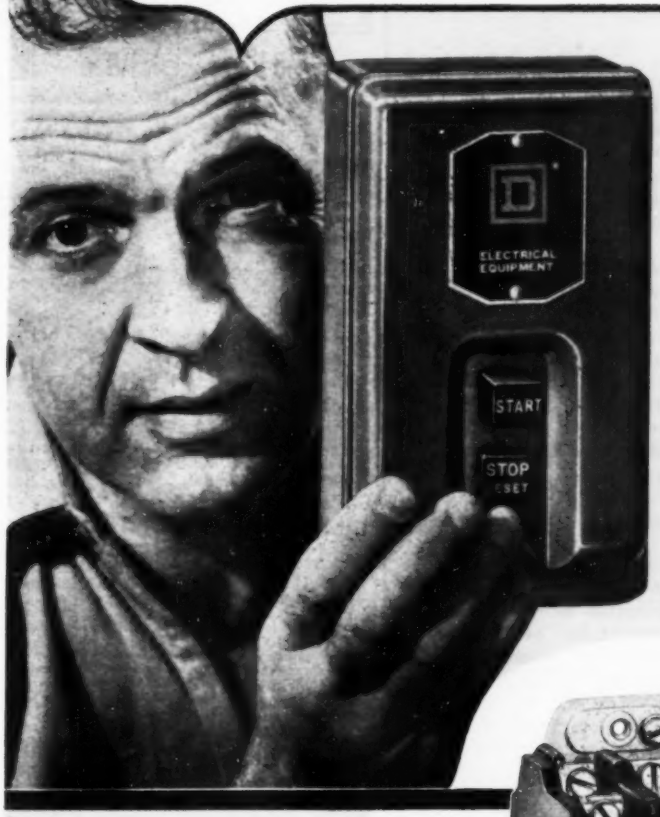
This very readable study answers these questions in detail. It is a thorough study of these industries: iron and steel, textiles, machine tools, and electric power equipment. The conclusions are of interest to every student of US industrial history.

Our present view of business in the last century is perhaps too largely influenced by the spectacular excesses of what Mark Twain called The Gilded Age. We are dazzled by the exploits of the land speculator, the mining magnate, the builder of railroad empires. Actually, as this new book shows, these gamblers were the exception rather than the rule. The 19th Century manufacturer took risks—but cautiously. He lived in a society "that experienced an unprecedented technological revolution in manufacturing methods, a change that was brought about, not by heroic gambling, but by the cautious exploitation of vast and multiplying opportunities."

Innovations of machine-tool builders helped greatly to bring about the Industrial Revolution. Americans developed the first widely used milling machines and turret lathes, also pioneered in the manufacture of objects with interchangeable parts. But innovators were a small minority, compared to copying firms; yet the firms that *did* take risks were the most successful and long lived, for risk in the machine-tool industry was not so great as in others. Failure of a company, in other words, was almost never caused by an unsuccessful technological innovation.

The author gives two reasons why risks among established machine-tool builders were relatively low: "First, their innovations were planned by mechanics and businessmen who thoroughly understood the economics and technology of metal-

This NEW Manual Starter has EVERYTHING!



NEMA Sizes 0 and 1

Two, three and four-pole construction

SMALLER! Takes less space, whether it's built into machine or mounted externally

SMART STYLING! Matches the streamlined appearance of today's modern machines

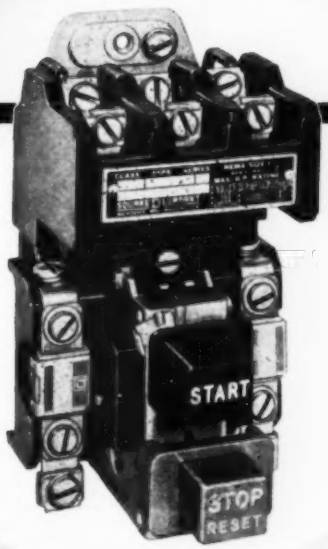
QWIK-MAKE, QWIK-BREAK! Positive snap-action opening and closing of contacts. Longer contact life

TRIP-FREE OVERLOAD PROTECTION! Impossible for operator to hold motor circuit closed against overload

POSITIVE PROTECTION! Starter will not operate *without* overload units installed

LONGER LIFE! *Toggle Action* operating mechanism. Heavy-duty construction throughout

EASIER INSTALLATION! Wire it without removing starter from enclosure. All terminals have pressure wire connectors



EASIER MAINTENANCE! "Off-the-Shelf" parts kits make normal maintenance and modifications easier than ever. They're easy to buy, easy to identify, and faster to install

TAMPER-PROOF! Cover padlocking device prevents tampering by unauthorized personnel. Safety latch locks "start" button in "OFF" position

VISIBLE INDICATION OF OVERLOAD! Self-centering push-buttons show when overload has occurred

CHOICE OF ENCLOSURES:

Water and Dust-Tight
Hazardous Locations
Flush Mounting

Write **for BULLETIN 2510 B-C**
Address Square D Company, 4041 North Richards Street, Milwaukee 12, Wisconsin

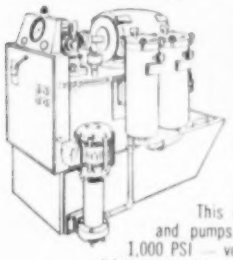
EC&M HEAVY INDUSTRY ELECTRICAL EQUIPMENT...NOW A PART OF THE SQUARE D LINE

SQUARE D COMPANY

SEALOL
GUN DRILLING ACCESSORIES help you

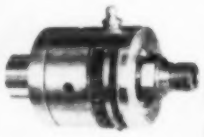
DRILL FINISHED HOLES IN ONE PASS

Adapt your present equipment for modern gun drilling with these specially designed gun drill accessories.



the original HI-PRESSURE COOLANT SUPPLY UNIT
The heart of any gun drilling operation is proper coolant in generous quantities. This unit filters, cools and pumps at pressures to 1,000 PSI — volumes to 40 GPM (higher capacities available).

END ATTACHED COOLANT TRANSFER



Attached to the outboard end of hollow-spindle equipment to transfer coolant to the rotating gun drill. Pressures to 1,000 PSI and speeds to 10,000 RPM.

GUN DRILL ADAPTOR
Not illustrated—for solid spindle equipment. The coolant transfer is integral with the adapter spindle.

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working. Second, it was easy to keep resources devoted to single experiments within safe limits because the cost of a new machine tool was low, generally between $300 and $3000. . . . There can be no doubt that failures occurred, but . . . the pace of technological progress was easily sustained by firms that had been innovating for decades."—*TJ*

•

UNIONS IN AMERICA, A BRITISH VIEW
—By B C Roberts, Reader in Industrial Relations, University of London. Published by Industrial Relations Section, Princeton University, Box 248, Princeton, N J. 136 pages, paperback. Price $2.

Professor Roberts is an authority on British industrial relations who has studied US practice both in the literature and by visit. During the past year he has been a visiting professor at Princeton and MIT and took the opportunity to study the US labor scene more closely. This book summarizes his impressions.

Reading it, with the fresh perspective it provides, had somewhat the same effect on this reader as dic Churchill's history of the Civil War.

Many readers will turn first to the section on corruption, which Prof Roberts describes as "astonishing to the onlooker from overseas." He finds, however, that corruption is deeply imbedded in the political and commercial life of America. He is also shocked to find that some employers are only too eager to use criminals, "and make no bones about their preference for a union leader of James Hoffa's type over one like Walter Reuther."

More valuable are the sections on wage bargaining and the climate of industrial relations. In Britain there are few strikes today over wages but many on the details of relations between management and labor—the labor contract as we know it in this country does not exist. Most US strikes are settled by a contract that both sides consider legally binding. One disadvantage is that grievances are settled on a strict interpretation of the contract rather than an effort to resolve the cause of the problem.

Among a half dozen basic conclusions, Prof Roberts finds less democracy in American unions, he feels the unions have reached their pinnacle unless they find the key to organizing a larger proportion of clerical, technical, and professional workers.

This slender book can be highly recommended for a broad, fresh view of unions in America—*AA*

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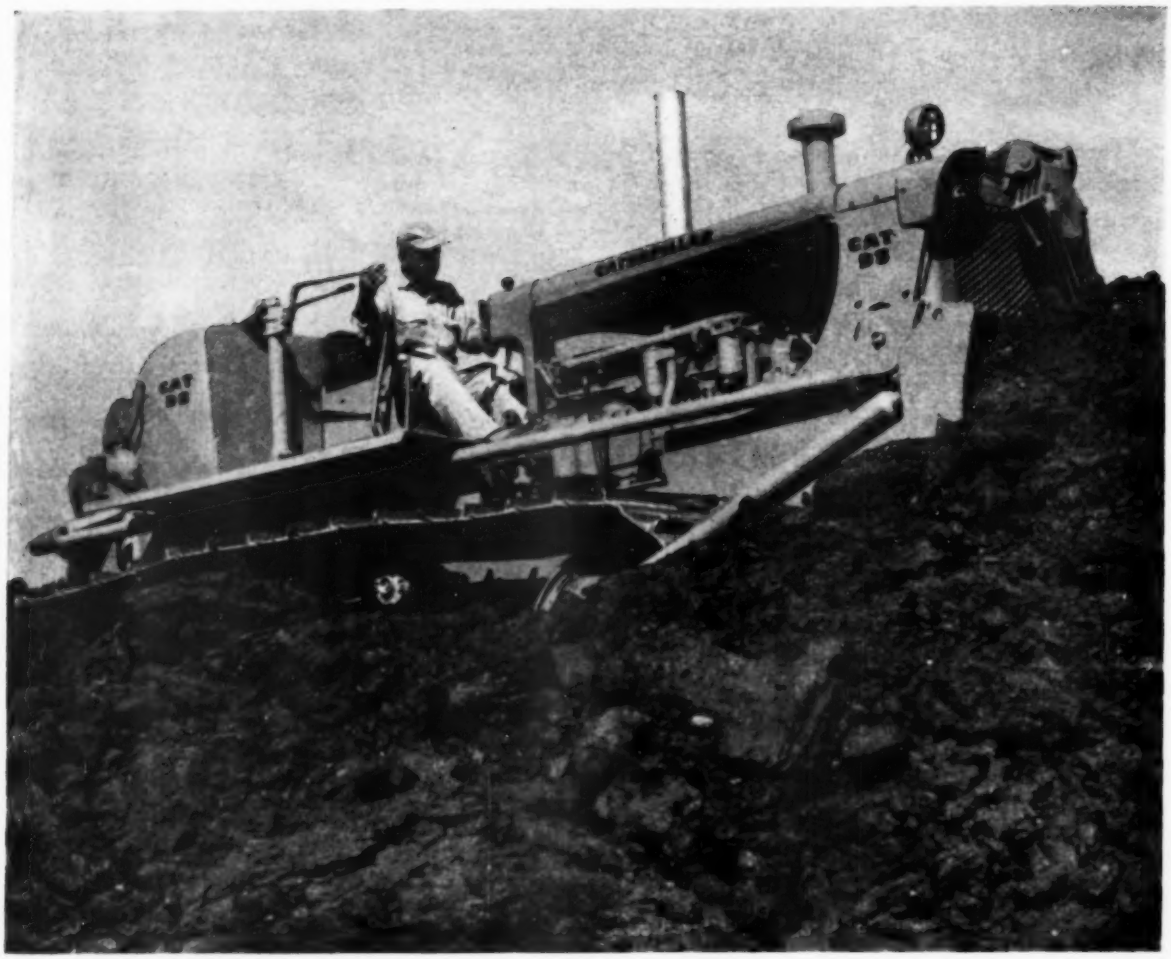

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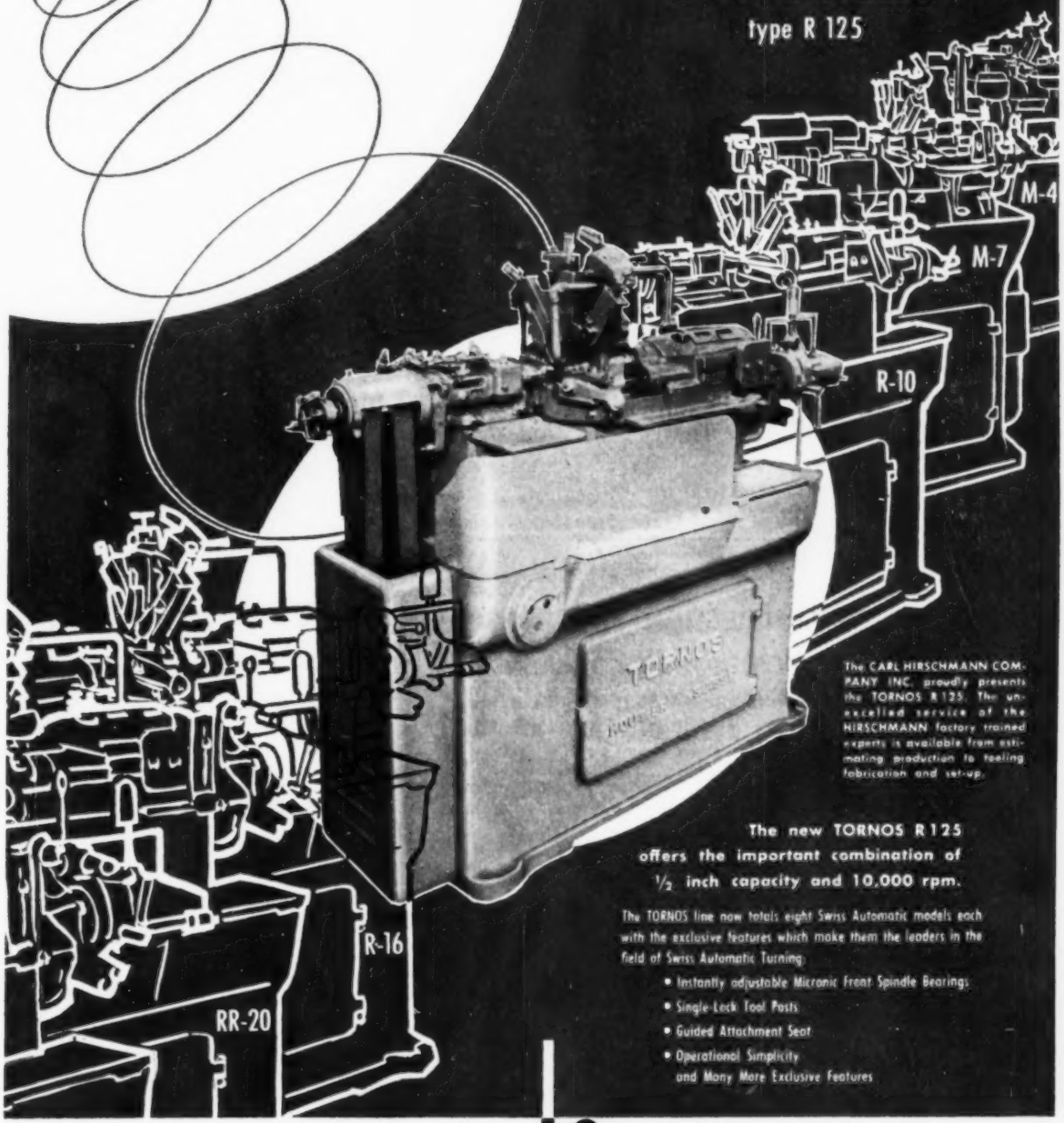

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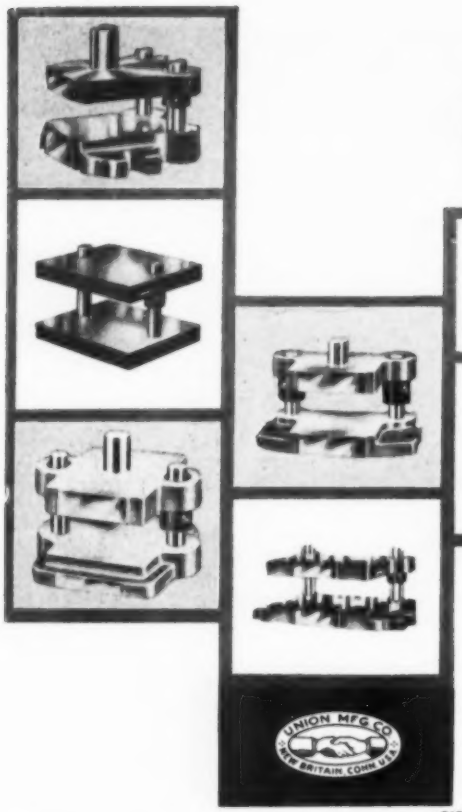

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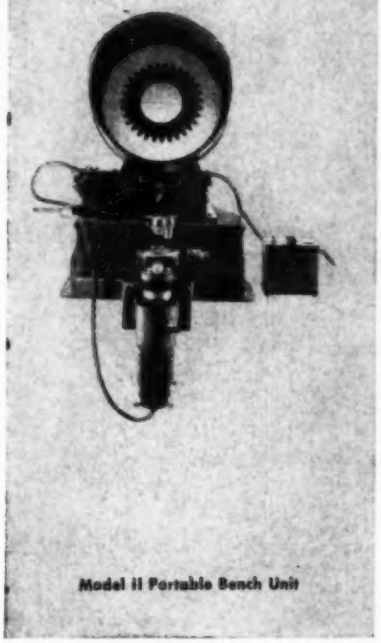

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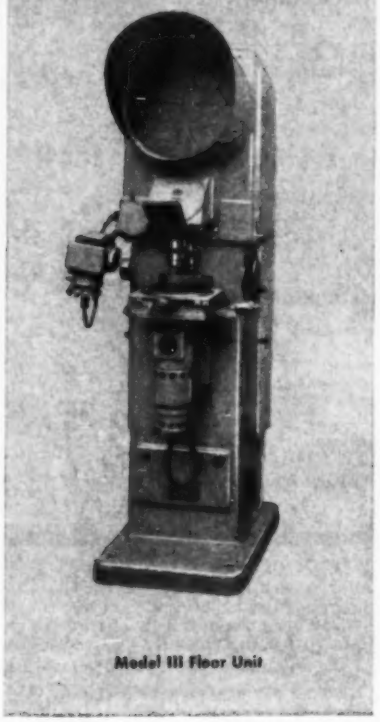

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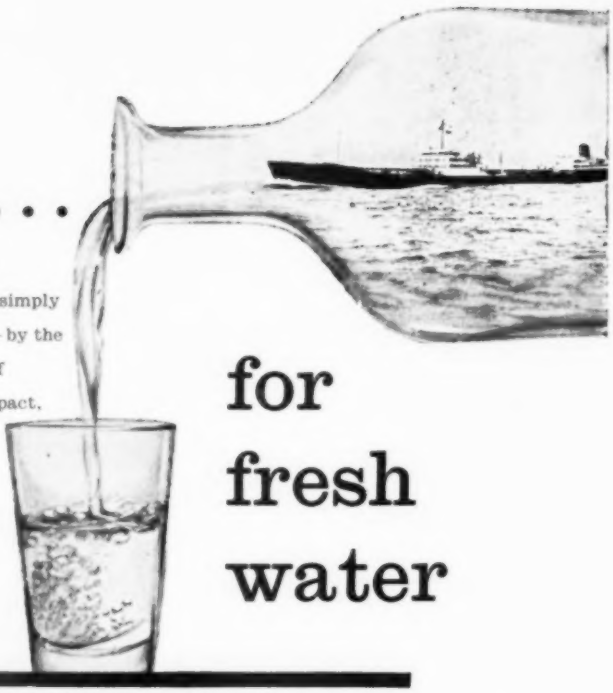

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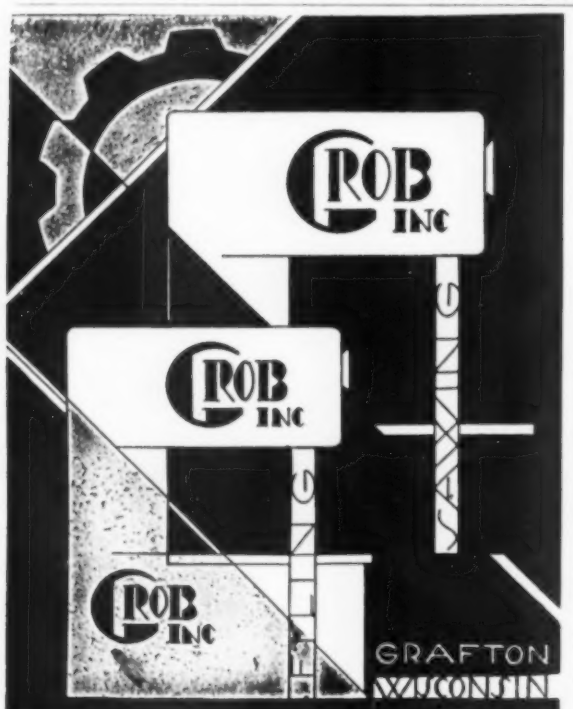

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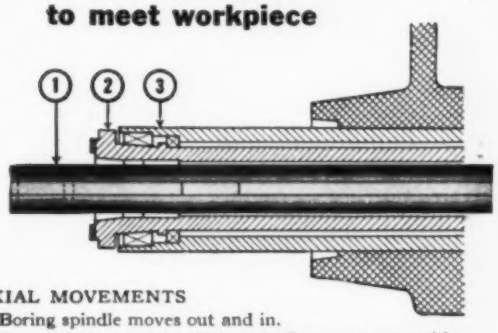

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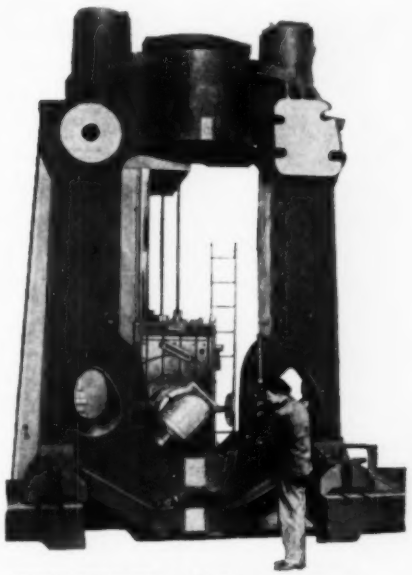

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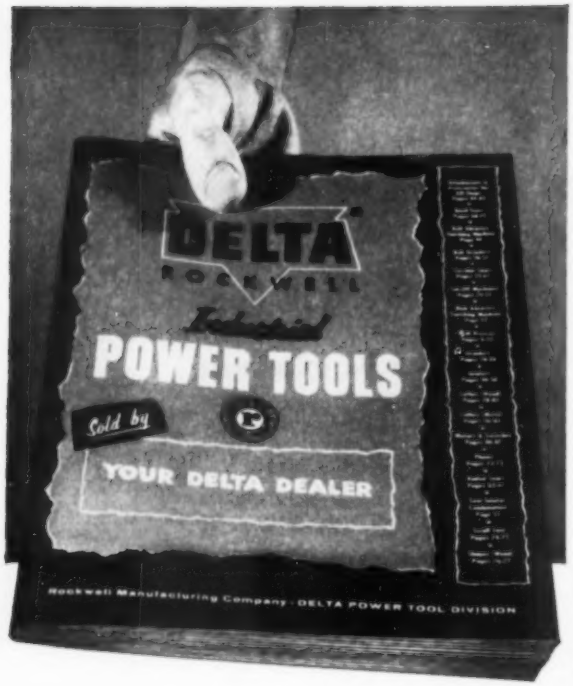

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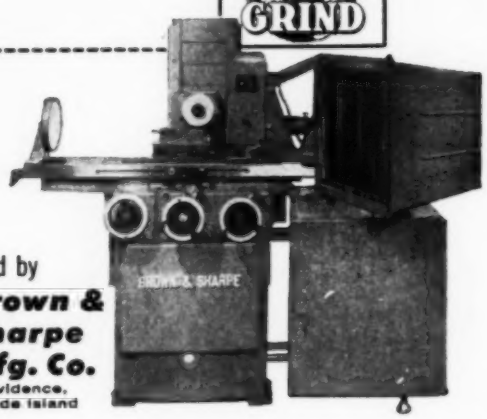

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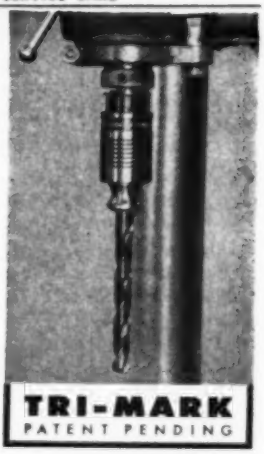

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Listed below are used, surplus new and rebuilt machine tools or services as advertised in this section.

The numbers after the advertiser's name, indicates the products or services offered by the advertiser

6. Boring Mills
16. Drilling & Reaming Machines
18. Engraving Machines
24. Grinding Machines
29. Lathes
33. Milling Machines
37. Planers
40. Press Brakes
41. Presses
50. Shapers
51. Shears

ADVERTISER	Page No.	KEY TO PRODUCTS OR SERVICES
Cincinnati Machinery Co.	253	6, 24, 29, 33, 37, 50
Eastern Machinery Co.	253	29, 33
Falk Machinery Co.	252	16, 24, 29, 33, 41, 50
Hyman & Sons, Joseph	252	40, 41, 51
Republic Machinery Co.	252	6
Southern Tool Manufacturing Co.	253	18, 33

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16"x29½" centers Lodge & Shipley Selective Head, m.d.
16"x29½" centers Monarch Geared Head, m.d.
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16"x102" centers LeBlond H.D., m.d.
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No. 000 Brown & Sharpe Plain Production, m.d.
No. 00 Cincinnati, rise and fall, 1944
M80 Taylor & Fenn Duplex, spline, m.d.
No. MM-1-6 U.S. Multi-Miller, m.d.
No. 33H Sundstrand Triplex Rigidmill, m.d.
No. 3A Sundstrand Plain Automatic Rigidmill, m.d.
24" Cincinnati Duplex Automatic, m.d.
Model 1404 K & T Simplex, m.d., production
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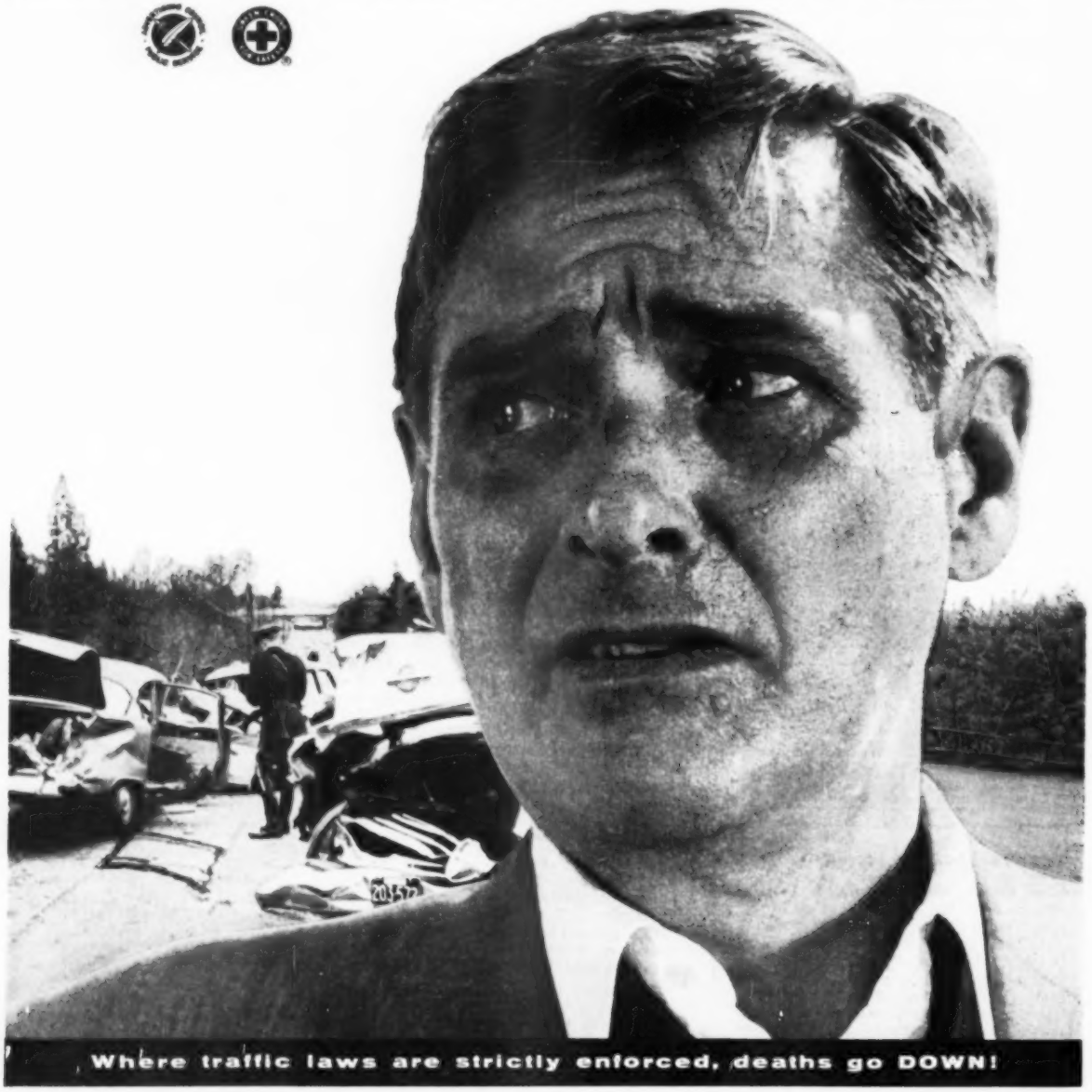

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INDEX TO ADVERTISERS

This index is published as a convenience to the readers. Every care is taken to make it accurate, but AMERICAN MACHINIST assumes no responsibility for errors or omissions.

	Page
Abrasive Products Inc.	223
Accurate Bushing Company	198
Airborne Instruments Laboratory	243
Allegheny Ludlum Steel Corp.	216
Allen-Bradley Company	211, 212
Allen Mfg. Company	182
American Brass Company	81
American Chain & Cable Wilson Mechanical Instrument Div.	226
American Machinist	179
American Schiess Corp.	219
American Smelting & Refining Co.	237
American Steel & Wire Division	48-49
American Tool Works Co.	109
American Waldrich Mfg. Company	218
Armstrong Blum Mfg. Company	68
Armstrong Bros. Tool Company	24
Avey Division of Motch & Merryweather Co.	77
Baker Bros., Inc.	72
Bardons & Oliver, Inc.	78
Bath & Co., Inc., John	213
Baush Machine Tool Co.	69
Beaver Pipe Tools, Inc.	217
Behr-Manning Corp.	104
Bethlehem Steel Company	87
Bijur Lubricating Corporation	233
Blake Co., Edward	226
Bliss Co., E. W.	257, 259
Bliss & Laughlin, Inc.	40-41
Boltmaster Company	222
Brown & Sharpe Mfg. Co.	91
Bryant Chucking Grinder Company	70
Buffalo Forge Company	30-31
Bullard Company	98
Burg Tool Mfg. Company, Inc.	20-21
Butterfield Division Union Twist Drill Company	66
Carpenter Steel Company	84-85
Century Electric Company	196-197
Chicago-Latrobe Company	110
Chicago Screw Company	234
Cincinnati Gear Company	206

(Continued on page 256)

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Air clutch and brake. JIC controls plus dual air valve. Four square type gibs with bronze surfaced ways on ram. Hard bronze crankshaft bushings and ball seat. Ram counterbalances. Forced lubrication, etc.

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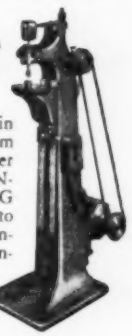

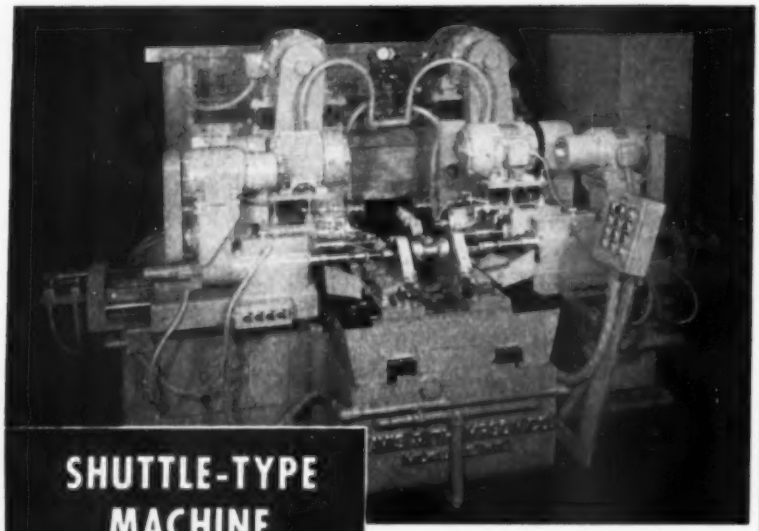

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Here's a good example of engineering a semi-standard machine to handle a lot of parts. Although this machine has been adapted to milling, centering, drilling and tapping of valve parts, its basic design lends itself to other operations through the addition of various types of heads as well as multiple spindle drill heads. Machine incorporates hydraulic controls for table feed and index, two milling heads, two hydraulic power heads, each with center drill and tap drill spindle, and two mechanical screw feed tapping heads to accommodate 16, 20 and 24 pitch threads. Capacities range from ⅜" to 4½" diameter, 5" to 23" long. Parts are inner valves for liquid level controls of tough #316 stainless steel.

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—of course you are. Every reader of American Machinist is.

Some find what they are looking for in the editorial pages, some in the advertising by manufacturers, some in the "Searchlight" advertisements. The latter includes many advertisements seeking or offering "something" — used, rebuilt, surplus new equipment, or a business opportunity that you may be able to supply, or want.

You will always find checking the "Searchlight" ads interesting, informative and profitable.

INDEX TO ADVERTISERS

(*Continued from page 255*)

	Page
Cincinnati Lathe & Tool Company	80
Cincinnati Milling Machine Company Cincinnati Milling Products Div.	79
Cincinnati Milling Machine Company	5, 6-7
Cincinnati Shaper Company	34
Clark, Cutler-McDermott Company	236
Clearing Division of U. S. Industries, Inc.	191
Cleveland Crane & Engineering Co.	22-23
Cleveland Grinding Machine Company	250
Columbia-Geneva Steel Div.	48-49, 67
Columbus Die-Toool & Machine Co.	230
Continental Tool Works Div. Ex-Cell-O Corporation	71
Cosa Corporation	249
Covel Mfg. Co.	188
Cross Company	28-29
Davis & Thompson Company	256
De Laval Steam Turbine Company	156
Delta File Works Inc.	220
Delta Power Tool Div. Rockwell Mfg. Co.	250
Deltronic, Inc.	257
Disston, Henry, Div. of H. K. Porter Company, Inc.	207
Dow Chemical Co.	52-53
du Mont Corporation	88
Dykem Company	248
Eagle Picher Company	189
Elgin National Watch Co. Abrasives Div.	232
Ex-Cell-O Corporation	71, 96, 112
Fafnir Bearing Company	244
Farquhar Div., A. B. Oliver Corp.	221
Fellows Gear Shaper Company	8-9
Felters Company	194
Gardner Machine Company	25
Giddings & Lewis Machine Tool Co.	184-185
Gisholt Machine Company	43-46
Goss & de Leeuw Machine Company	240
Grant Mfg. & Machine Company	255
Greaves Machine Tool Company	210
Greenlee Brothers & Company	100
Grob, Inc.	248
Gulf Oil Corporation	55-58

INDEX TO ADVERTISERS

	Page
Hanson-Whitney Company	215
Hardinge Brothers, Inc.	86
Hartford Machine Screw Company	234
Heald Machine Company Sub. Cincinnati Milling Machine Co.	2nd Cover
Heller Tool Company Sub. Simonds Saw & Steel Co.	93, 94
Hirschmann Company, Inc., Carl	245
Hy-Pro Tool Co.	54
Jacobs Mfg. Company	82-83
Jessop Steel Company	154
Johnson & Son, Inc., S. C.	224-225
Jones & Lamson Machine Company	92
Kearney & Trecker Corporation	60-61
Kennametal Inc.	227
L & J Press Corp.	255
Landis Machine Company	10-11
Landis Tool Company	12-13
LaPointe Machine Tool Company	26-27
La Salle Steel Co.	62
Latrobe Steel Company	195
Leland-Gifford Company	89
Lilly & Co., Eli Agricultural & Industrial Products Div.	35
Lincoln Electric Company	160
Linley Brothers Company	198
Lipe Rollway Corp.	231
Lodge & Shipley Company	106
Lucas Machine Division New Britain Machine Campany	75, 76
Machine Controls Div. Servo Valve Amplifiers Div. Minneapolis Honeywell Regulator	178
Malleable Castings Council	150-151
Manhattan Rubber Div. Raybestos-Manhattan, Inc.	42
Master Power Corp. Black & Decker Subsidiary	183
Mattison Machine Works	201
M. B. I. Export & Import Ltd.	239
McGraw-Hill Book Co., The	242
McKay Machine Company	186-187
Micromatic Hone Corp.	204-205
Miller Electric Mfg. Co., Inc.	258
Modern Devices Sub. Twentieth Century Mfg. Co.	200
Moline Tool Company	246
Moore Special Tool Co., Inc.	192

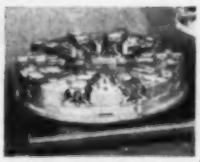
(*Continued on page* 258)

CONTOUR GRIP

on a lathe... Contour Grip works with any two, three or four jaw chuck, wrench or air operated.

SET UP ANY JOB IN SECONDS
then take deeper cuts, faster feeds

on a milling machine ... Contour Grip makes high speed milling of tough-to-hold parts easy.



on a grinder... this multiple set-up on a Blanchard helped a manufacturer increase his output ten-fold!

Any tool becomes more productive when you use Bliss' new Contour Grip holding fixture; any operator becomes faster.

Contour Grip is a standard fixture that will hold any irregularly shaped part so tightly that you can feed faster and take deeper cuts. It can be used with *any* type of tool, eliminating the need for costly special-purpose jigs and fixtures. And, as picture above shows, your operator can set-up Contour Grip in seconds, then go from piece to piece just by backing off the jaws, dropping the next piece in and tightening up. For long runs or short, it's as simple and as quick as that.

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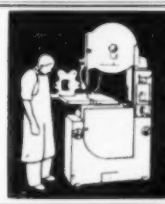

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U.S. Patent 2,715,281

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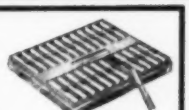

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c. Its new completely sealed semi-metallic rectifier — designed for welding — provides the most efficient d-c for welding ever devised.

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miller WELDERS

GOLD STAR *All-Weather* SRH

The features that set the SR above and beyond the normal standards of welder performance belong to the SRH also. But, in addition to the horizontal design for easier stacking and paralleling, this welder has an "all-weather" construction that includes baked varnish coated transformers and rectifiers plus phosphatizing and painting of all base and sheet metal — even fan blades. Cam-Lok receptacles are standard equipment. The Gold Star SRH welds real well.

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INDEX TO ADVERTISERS

(Continued from page 257)

	Page
Morse Twist Drill & Machine Company	14-15
National Acme Company	64-65
National Machinery Company	208-209
National Tube Division	48-49
Nebel Machine Tool Corporation	175
New Britain Machine Co. The Lucas Machine Division	75, 76
Nikon Incorporated	247
Norton Company	18-19, 33
Oakite Products, Inc.	214
Ohio Crankshaft Company	149
Oliver Corp. A. B Farquhar Division	221
Orban Inc., Kurt	173
Osborn Mfg. Co.	229
Pacific Industrial Manufacturing Co.	158
Pacific Tool & Mfg. Co.	250
Pipe Machinery Company	32
Raybestos Manhattan Inc.	42
Republic Steel Corp.	36-37
Richardsons, Westgarth & Co., Ltd.	248
Rockford Machine Tool Company	202-203
Rodgers Hydraulic Inc.	63
Sciaky Bros., Inc.	260
Screw & Bolt Corp. of America	200
Sealol Corporation	242
Simonds Saw & Steel Company	102
Sinclair Refining Company	73
Square D Company	241
Standard Screw Company	234
Starrett Co., L. S., The	159
Steelweld Machinery Division Cleveland Crane & Engineering Company	22-23
Sun Oil Company	177
Tannewitz Works	257
Tennessee Coal & Iron Div.	48-49, 67
Texaco Inc.	259
Texas Company	259
Thompson & Son Co., Henry G.	199
Thompson Grinder Company	74
Timken Roller Bearing Company	4th Cover
Torrington Mfg. Company	50-51
Torrington Company Swaging Machine Division	238

INDEX TO ADVERTISERS

	Page
Union Mfg. Company	246
United States Steel Corporation	48-49, 67
U. S. Steel Export Company	48-49, 67
United States Steel Supply	48-49
U. S. Tool Co., Inc.	3rd Cover
Universal Cyclops Steel Corp.	152
Valvoline Oil Company Division Ashland Oil & Refining Co.	190
Van Keuren Company	90
Vascaloy-Ramet Corporation	171
Vlier Engineering Corp. Sub. Barry Controls Inc.	47
Walker Co., Inc., O. S.	59
Warner & Swasey Company	16-17
Western Automatic Machine Screw Co.	234
Westinghouse Electric Corp.	38-39
Wilson Mechanical Instrument Div. American Chain & Cable Co., Inc.	226
Winslow Product Engineering Corp.	228
Youngstown Sheet & Tube Company	181

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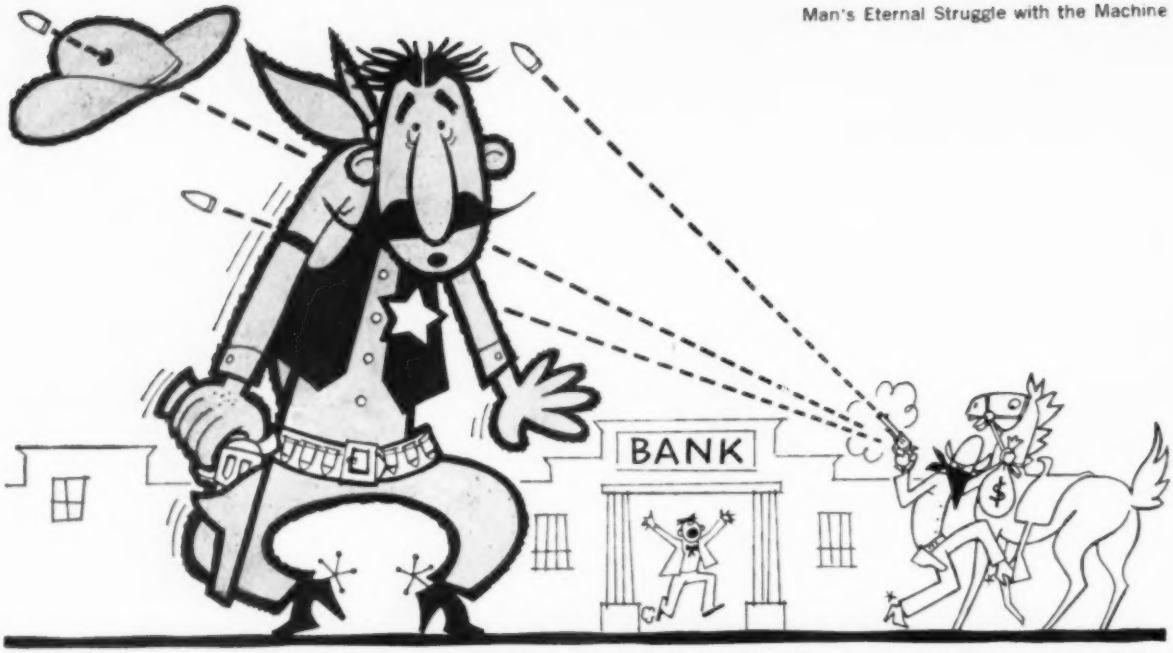

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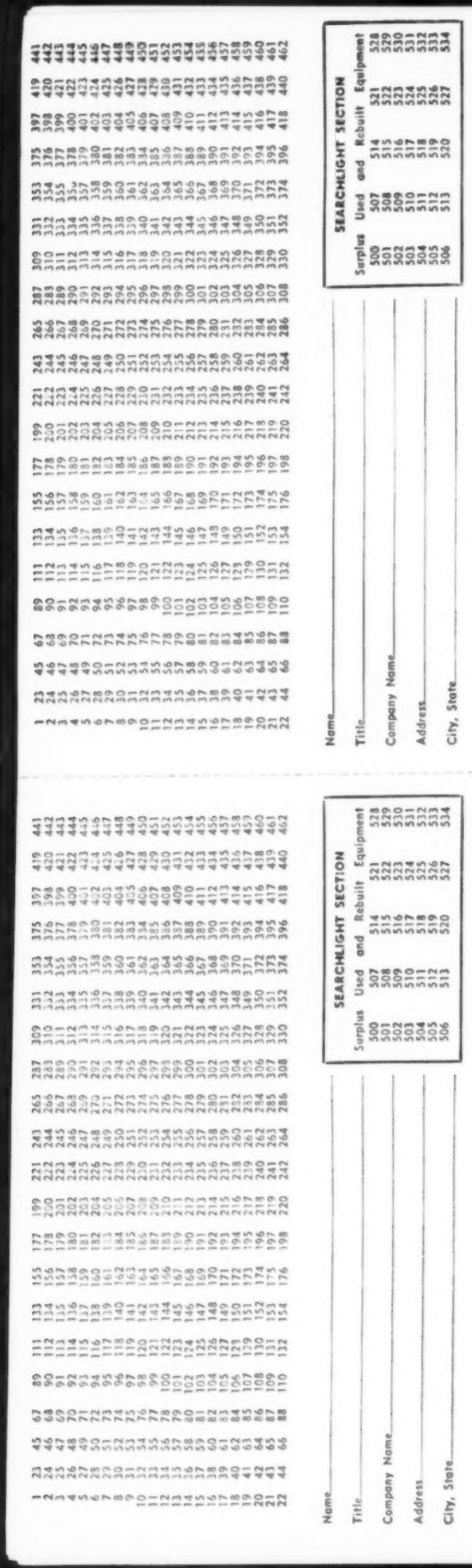

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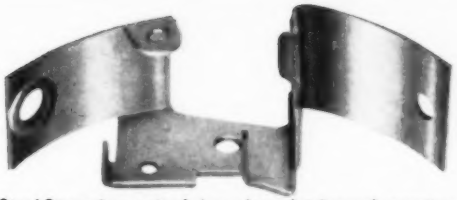

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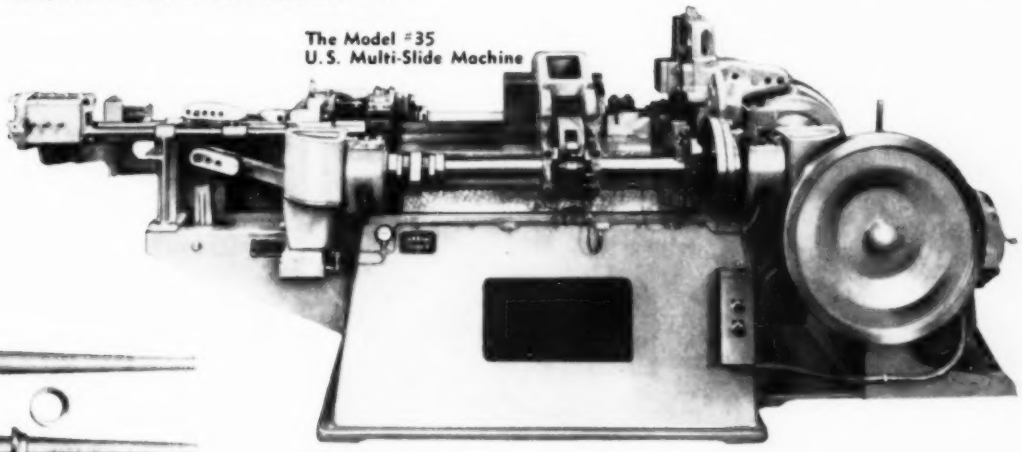

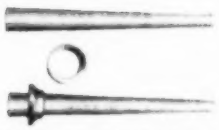

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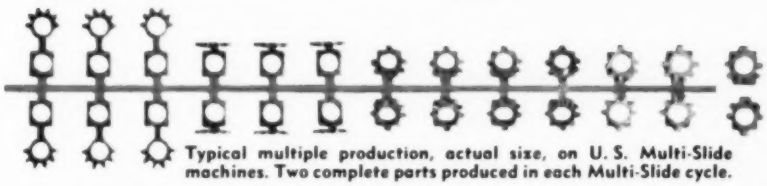

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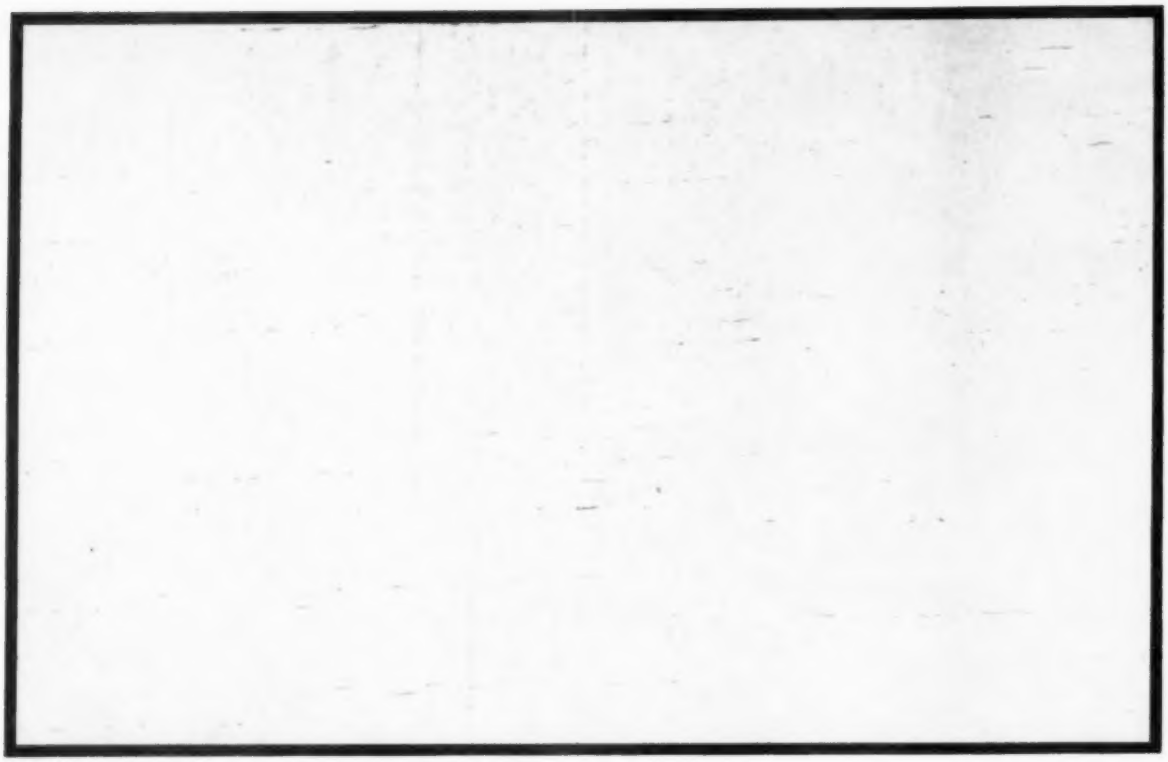

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